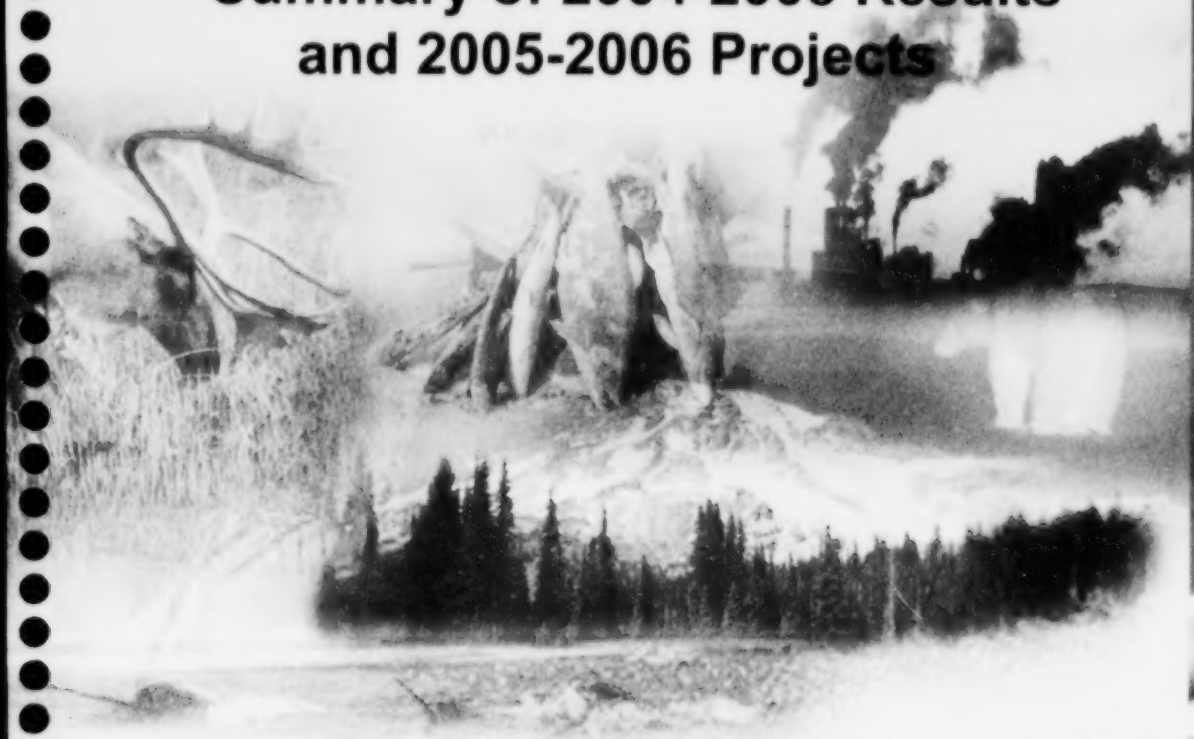
Northern Contaminants Progra

Summary of 2004-2005 Results and 2005-2006 Projects



Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

Canada

Summary of NCP

2004-2005 Results and 2005-2006 Projects

Foreword:

The Northern Contaminants Program (NCP) was established in 1991 in response to studies which showed the presence of contaminants in the Arctic ecosystem. Many of these contaminants had no Arctic sources. The three main contaminant groups of concern are persistent organic pollutants (POPs), heavy metals and radionuclides. Some of these contaminants are found at unexpectedly high levels in animals at the top of the food chain and in humans. The NCP is led by Indian and Northern Affairs Canada and brings together federal departments (Indian and Northern Affairs Canada, Health Canada, Environment Canada, and Fisheries and Oceans Canada), the three territorial governments (Yukon, Northwest Territories, and Nunavut), northern Aboriginal organizations (Council of Yukon First Nations, Dene Nation, Inuit Tapiriit Kanatami, and Inuit Circumpolar Conference - Canada) and university researchers. Together they work towards reducing and, wherever possible, eliminating contaminants in traditionally harvested foods and provide information that assists informed decision making by individuals and communities in their food use.

Between 1991-1996, NCP research was focussed on assessing where contaminants were found in the Arctic, at what levels, and confirming the source region. From 1998-2003, under Phase II, the NCP shifted towards a greater emphasis on human health research, developing effective community dialogue, increasing community participation, and working towards international agreements to control the release of contaminants. Three of these agreements have now come into force. Under the current phase of the NCP, the focus is on protecting Aboriginal health and safety as a result of exposure to contaminants from consuming traditional/country foods, and on fulfilling Canada's obligations under

The NCP funds research on northern contaminants issues. A portion of its funds is directed to communicating research results to northern communities. The education and communications part of the program is led by the representatives of the northern Aboriginal organizations.

People and organizations seeking funding for projects related to northern contaminants issues submit proposals to the NCP each year. A management committee consisting of representatives from governments and northern Aboriginal organizations meet to evaluate the proposals and approve funding for projects which meet the goals of the program. Anyone conducting research in the North is required to consult with the communities that will be involved in the research and to submit completed consent forms. Project leaders are required to present their results at an annual NCP workshop, and to submit a brief description of their research results at the end of the year. Every year since 1991 these results have been published as the "Synopsis of Research Conducted Under the Northern Contaminants Program". These documents are available through the NCP. More information about the program can be found on the NCP website: **http://www.ainc-inac.gc.ca/ncp/**

This electronic booklet, the "Summary of Northern Contaminants Program 2004-2005 Results and 2005-2006 Projects" provides a quick, non-scientific reference guide for communities and other interested groups on current-year projects being conducted by the NCP.

HOW TO USE THIS BOOKLET

To help you find the information in this booklet that is of interest to you:

- The booklet is divided into five sections based on the geographical location of where projects are or will be mainly occurring (The Yukon Territory, The Northwest Territories, Nunavut, Nunavik/Labrador and Other Locations).
- Each project summary contains the question the project is answering, a summary, and location.
- There are "icons" (please see following page) located throughout the pages of the booklet to help communicate what the project is about, how you can get more information about the project, and where and when the project is occurring.
- The **bold** words within the text of the booklet are defined in the Glossary of Terms in Appendix A at the end of the booklet.
- A new section has been added this year, which contains plain language results that were obtained from projects that occurred during the previous fiscal year.
- If you wish to search for a project by affiliation or project leader, or by key subject areas or contaminant please refer to Appendix B (Affiliations and Project Leaders) and Appendix C (Key Subject Areas and Contaminants) at the end of the booklet.
- If you have more questions about any of these projects, contaminants in the North or contaminants in general, there is a list of people whom you can contact for this information in Appendix D (For More Information) at the end of the booklet.

Explanation of icons used in this booklet

106-00535/

PROJECT CATEGORY

- Human Health Project
- Monitoring Project
- Communications Project
- International Policy Project

WHAT THE PROJECT IS STUDYING:

- Persistant Organic Pollutants (POPs)
- Heavy Metal Contaminants
- Radionuclide Contaminants
- HG Mercury
- TK Traditional Knowledge
- Traditional Food
- Education
- Administration
- QA/QC Quality Assurance/ Quality Control
- Seals
- Walrus
- Whales
- Fish
- Seaducks
- Seabirds
- Arctic Foxes
- Polar Bears
- Caribou
- Dall's Sheep
- Marine Mammals
- Moose
- Mink
- Wolverines
- People
- Children
- Snow
- Ice
- Rain
- Water
- Ocean
- Air
- Sediments

OTHER DETAILS:

- The project involves fieldwork
- The project involves work taking place in a laboratory
- The project involves computer models and database work
- The project involves a workshop and/or a meeting
- Contact information
- The time frame of the project
- The schedule of the project
- The location of the project

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The Yukon Territory

The Yukon Territory

Distribute and Communicate NCP Relevant Information to Yukon First Nations and CYFN General Assembly

How can the Council of Yukon First Nations best provide the Yukon First Nation communities with CACAR II information?

PROJECT SUMMARY:

The current focus of the **Northern Contaminants Program (NCP)** is to address issues in communities that are exposed to **contaminants** at levels of concern to health authorities. Despite relatively low levels of contaminants in the region, Yukon communities are still concerned about contaminants and have asked about how the disturbances to the environment affect health. Many of the answers to these questions are discussed in **Canadian Arctic Contaminants Assessment Report II (CACAR II)**. It is, therefore, the Council of Yukon First Nations' role to arrange proper distribution of the information found in CACAR II to all the communities in the Yukon.

This project will continue to participate in NCP activities at the territorial and management level. It will distribute the most recent material coming from the program and answer any questions the communities may have on the material being presented to them. It will also deliver the new communications package to three or more communities during planned workshops. The Yukon contaminants database will be updated with 2004-2005 data. The YCC will also begin working on the outline for the nutritional handbook in consultation with the Yukon government's First Nation Nutritionist Program. It will also continue to co-ordinate contaminants studies in the Yukon, communicate the results from the research and complete the evaluation of past communication strategies.

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TIME FRAME:
April 2005 - March 2006

LOCATIONS OF WORK:
Yukon

SCHEDULE:
For more information on the project, please contact the project leader directly

Yukon Contaminants Committee Communication in 2005-2006

Will community workshops and new communication packages effectively relay important information to Northern communities?

PROJECT SUMMARY:

Since 1991, the Yukon **Contaminants** Committee (YCC) has worked at keeping Yukon people informed of **Northern Contaminants Program (NCP)** initiatives. By coordinating the communication of contaminants information and research in the Territory this has been made possible. The committee membership is diverse and consists of representatives from several federal and territorial departments, the Council of Yukon First Nations (CYFN), the Yukon Conservation Society and Yukon College. In 2004-2005 a communication package was developed with the ability to add components that address concerns specific to individual communities.

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TIME FRAME:
April 2005 - March 2006

LOCATIONS OF WORK:
Yukon

SCHEDULE:
For more information on the project, please contact the project leader directly

Long Term Trends of Halogenated Organic Contaminants and Metals in Lake Trout from Two Yukon Lakes: Kusawa and Laberge

? *Have contaminant levels in Yukon trout changed over time?*

PROJECT SUMMARY:
Fish is an important traditional/country food and makes up a large part of Yukon community members' diet. In the outline for the **Northern Contaminants Program (NCP)** 2005-2006 Call for Proposals it states that the goal for **temporal trend** monitoring is to be able to detect a 10% annual change in **contaminant** concentration over a period of 10-15 years. This requires sample collection and analysis of a minimum of 10 fish annually for a period of 10-15 years. The Yukon government considers the fishery to be very important and has been monitoring **organochlorine (OC)** and metal contaminants in fish since 1993. Over the years, a temporal data set has been created along with an extensive archive of tissue samples for important subsistence fish species. This information will help generate trends for legacy and emerging contaminants.

This project will continue to assess the temporal trends of **bioaccumulating** substances such as trace metals, organochlorine contaminants, selected current use chemicals such as **brominated flame retardants (BFRs)**, and fluorinated organic compounds in lake trout from Lakes Laberge and Kusawa. Muscle and liver will be collected from a minimum of ten trout and analyzed for contaminant levels. A portion of each tissue will be archived for future sampling. During the analysis detailed biological information will be recorded for each individual so that contaminant levels can be expressed in relation to a number of relevant parameters. Trout tissue will also undergo isotopic analysis to determine trophic status and assess the stability of the **food web** in each lake.

LOCATIONS OF WORK:
1. Lake Laberge
2. Lake Kusawa

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
April 2005 - March 2006

Porcupine Caribou Monitoring Program

What are the current levels of contaminants found in the porcupine caribou herd?

PROJECT SUMMARY:
Over the last 10 years the Yukon Contaminants Committee (YCC) has studied **contaminants** in traditional/country foods. The results have shown that almost all traditional/country foods are safe to eat in the Yukon. It has been noted, however, that **cadmium** levels in moose and caribou liver and kidneys, and **mercury** in caribou kidneys are relatively high and have prompted a health advisory from Health Canada (HC). It is important that the YCC has the ability to respond to concerns over contaminant levels with data that is both local and current. YCC created a small cost effective annual hunter collection program through the YCC Hunter Survey Program, which has collected tissue samples annually since 1993. This long-term program has produced a valuable temporal database and an archival tissue sample set that aids in generating trends for any relevant "emerging" contaminants.

This project will determine temporal changes in contaminant levels in barren-ground caribou in the Yukon. Samples of kidney, liver, muscle and incisor bar will be requested from Yukon hunters through radio interviews, newspaper articles and letters to certain individuals. The fate and effects of contaminant deposition and transport to the Yukon will be investigated. Current levels of contaminants in traditional/country foods will also be determined for long term trend monitoring purposes of the Porcupine caribou herd. Any additional information gained from the research will be used to update health advisories accordingly.

LOCATIONS OF WORK:
1. Yukon

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
April 2006 - final report prepared
Fall 2006 - presentation of results

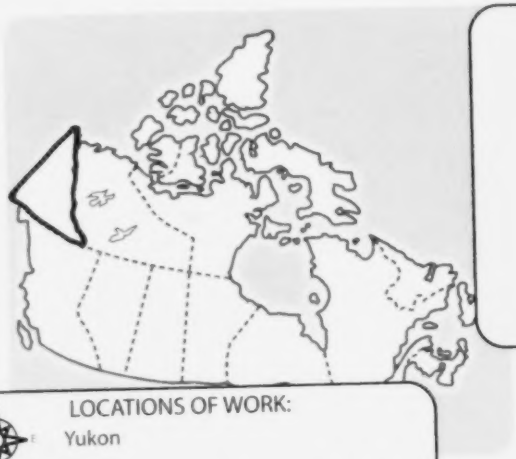
Yukon Contaminants Committee Coordination for 2005/2006

What is the most effective way to communicate research to the people of Yukon?

PROJECT SUMMARY:

Since 1991, the Yukon **Contaminants** Committee (YCC) has been the main connection between the residents of the Yukon and the **Northern Contaminants Program (NCP).** This committee is involved in keeping the Yukon people actively informed about the projects being undertaken through the program. The committee contains a diverse membership and is represented by several federal and territorial departments, as well as the Council of Yukon First Nations, Yukon Conservation Society and Yukon College. Due to the many years of continual effort by the YCC it has developed a local pool of expertise, a large list of publications, an NCP-based curriculum in-place with in the Yukon school system and an informed public.

This project will continue to coordinate contaminant projects in the Yukon and review all proposals presented in the Yukon, as well as provide a subjective review of all Yukon based communication initiatives. YCC members will also continue to make themselves available to the public and will participate in community meeting and workshops as required.



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TIME FRAME:
April 2005 - March 2006

LOCATIONS OF WORK:
Yukon

SCHEDULE:
For more information on the project, please contact the project leader directly

Hayley Hung - Northern Contaminants Air Monitoring and Interpretation

What and Where:
Weekly high volume air samples were collected over one year at two arctic sites: Little Fox Lake, Yukon, Canada and Point Barrow, Alaska, USA. All samples were analyzed for **organochlorine (OCs) pesticides**, polychlorinated biphenyls (**PCBs**), and polycyclic aromatic hydrocarbons (**PAHs**).

Top Three Findings:
1. The concentrations of pesticides which have been banned or restricted in use in most countries have shown decreasing trends in Arctic air.

2. Recently, studies have suggested that climate change may free contaminants from previously accumulated sinks, such as soil. Since the Arctic is the first place that witnesses climate change, we should continue to monitor these pollutants for changes and their resulting effects on the **ecosystem**.

3. Comparison of the air concentrations of pesticides that we have measured at Little Fox Lake, Yukon, with those observed at Point Barrow, Alaska, has shown some seasonal differences. Although both stations are located in the western side of the North American Arctic, they may receive these pollutants from different emission sources. Further investigation is needed to determine the cause of these differences in concentrations.

Importance of the Results:
The concentrations in most banned and restricted pesticides show decreasing trends in Arctic air. This implies that reduction in use of these pollutants in the South is effective in decreasing the amount of pollutants entering the Arctic through the air.

Future Activities:
Monitoring Arctic air for contmainants will continue at Alert, Nunavut as part of the NCP's Environmental Trends subprogram.

Gary Stern - Trace Metals and Organohalogen Contaminants in Fish from Selected Yukon Lakes: A Temporal and Spatial Study

What and Where:
In this project, samples of burbot and trout from Lake Laberge and Kusuwa Lake were analyzed for **contaminants**.

Top Three Findings:
1. In both lakes, levels are just below the recommended **mercury** guideline level for commercial sale but are at, or exceed, the guideline level recommended for fish used for subsistence.

2. In Lake Laberge, **POPs** continued to decline since 2003. In Kusawa, some POP concentrations have declined significantly since 2002, while others remain fairly constant.

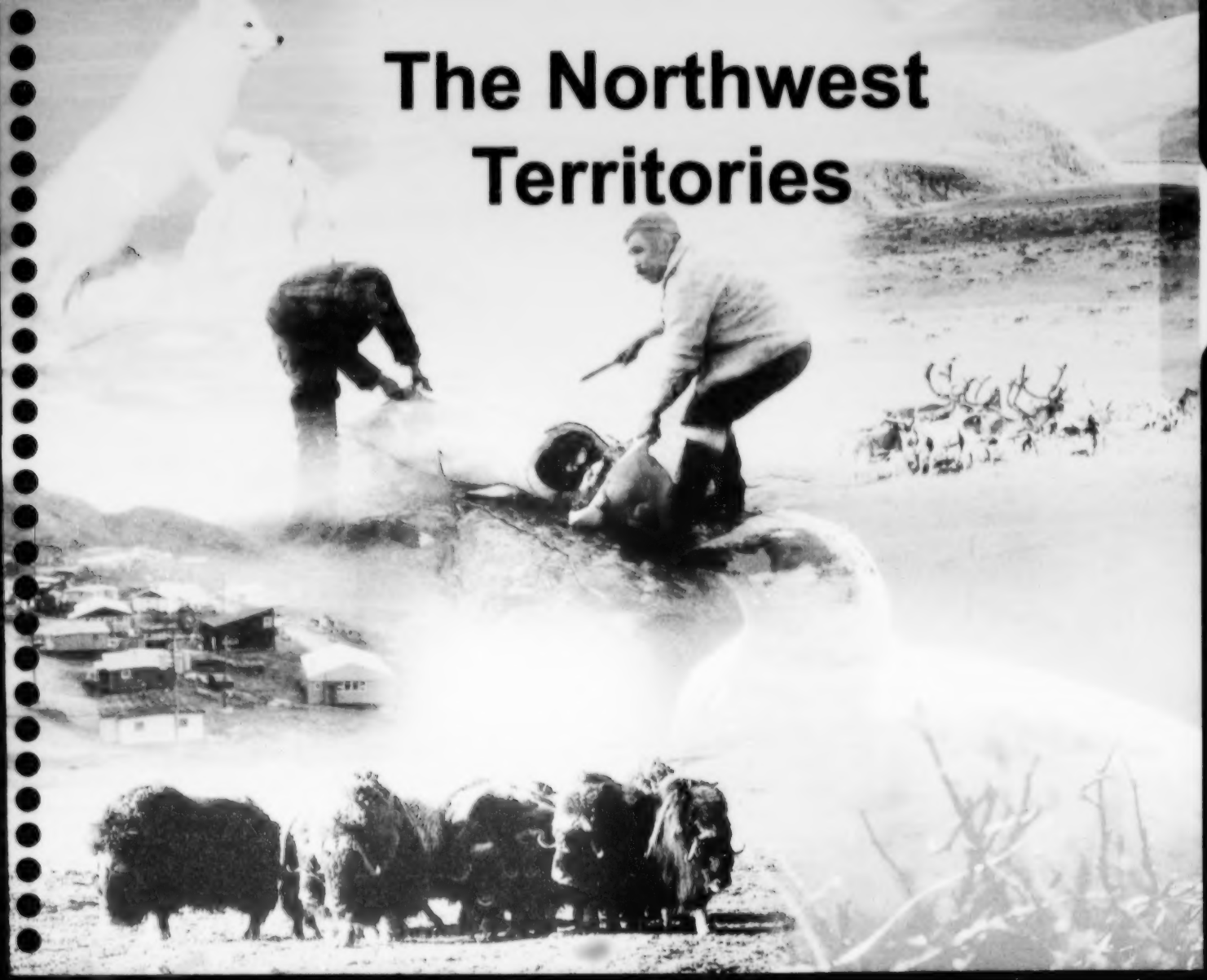
3. **Perfluorooctane sulfonate (PFOS)** was the dominant perfluorinated compound in Lake Laberge burbot in both the 2000 and 2004.

Importance of the Results:
Because of the importance of lake trout and burbot to the subsistence diet of northerners, the need to continue to assess the effect of climate variation on fish contaminant levels, and the availability of current data sets and archived samples, Lakes Laberge and Kusawa were selected as the priority Yukon sampling location for long-term **temporal trend** studies.

The results from this study help determine whether the levels of these contaminants in fish (health of the fish stock), and thus exposure to people who consume them, are increasing or decreasing with time. These results will also help to test the effectiveness of international controls.

Future Activities:
Yukon lake trout will be sampled annually as part of the NCP's Environmental Trends subprogram.

The Northwest Territories



N.W.T.

The Northwest Territories

HG

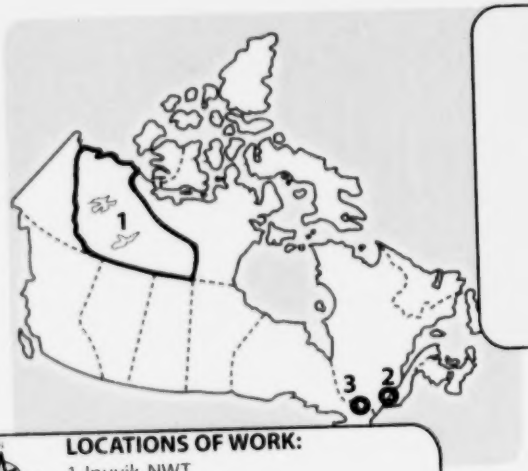
Monitoring Temporal Trends of Human Environmental Contaminants in the NWT. MOM's (Monitoring our Mothers Study): Environmental Health Trends-Inuvik Region-Expectant Mothers Blood Monitoring Program 2004-2005.

? *How are levels of contaminants changing in the blood of pregnant women in the Inuvik region?*

PROJECT SUMMARY:
Between 1994-1999 a territorial baseline of selected **organochlorine** and metal **contaminants** in maternal and cord blood was established for the Northwest Territories (NWT) and Nunavut. These two regions were specifically chosen to create a contrast between a region with higher levels of contaminant exposure (Baffin) to one with moderate exposure levels (Inuvik). Changes in contaminant levels since 1990 will be the focus of this project.

This project will establish a time trend of human exposure to specific environmental contaminants through the collection and analysis of blood and hair samples from pregnant women in the Inuvik region. Now entering the third year of a four year program, the project aims to recruit, sample and analyse samples collected from approximately 100 participants. Mothers will be interviewed prior to giving birth in Inuvik using a series of dietary and lifestyle questions. All of these activities will be conducted by the program coordinator, who is also responsible for designing the data spreadsheet, establishing the data management plan, and developing and updating recruitment and sampling materials.

The data obtained from this research will be valuable for Canada's efforts to meet its obligations under the **Persistent Organic Pollutants (POPs)** and **Heavy Metals** Protocols of the United Nations Economic Commission for Europe (UN/ECE) Convention on Long Range Transboundary Air Pollution (LRTAP) , as well as the **Stockholm Convention**.



LOCATIONS OF WORK:
1. Inuvik, NWT
2. Sainte-Foy, Quebec
3. Ottawa, Ontario

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
January 2005-March 2006 - maternal blood and hair samples will be collected and analysis will begin.

Developing and Delivering Appropriate Education and Communication Information for the Inuvialuit Settlement Region

How do we ensure our efforts are working in regards to communications?

PROJECT SUMMARY:
The communities of the Inuvialuit Settlement Region (ISR) harvest marine mammals as a main part of their diet. The **Canadian Arctic Contaminants Assessment Report II (CACAR II)** contains results that show that marine mammals and people who eat them may be at risk of exposure to **contaminants**. It is important that these communities get accurate, detailed information on the benefits of traditional/country food and the contamination risks from eating these foods. In 2004-2005, the Inuvialuit Regional Corporation (IRC) and Inuvialuit Game Council (IGC) undertook a project to determine both the short- and long-term communication needs of the communities.

This project will deliver long-range contaminant information to each of the six communities in the Inuvialuit Settlement Regions' (ISR) and advance the day-to-day activities training students how to best communicate **Northern Contaminants Program (NCP)** findings to northern communities. Regional Inuit communication materials/messages will be developed for target audiences, built around the key focus of what kinds and types of food choices beneficiaries are making. The need and feasibility of developing educational resources/curriculum will be assessed and a contaminants awareness poster will be developed and distributed. Survey results from 2003-2004 demonstrated a low recognition of long-range contaminant issues, a lack of understanding of these, and variation between regions. In order to better understand these results a case study review project will be taking place.

LOCATIONS OF WORK:
Inuvialuit Settlement Region

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
April 2005 - March 2006

Participation in the Northwest Territories Environmental Contaminants Committee and Contaminants Language Terminology Development - Deninu Kue First Nation

How can communicating contaminant information be improved?

PROJECT SUMMARY:

The results of past research projects have steadily been communicated to the communities that have been involved. However, many questions remain unanswered. It has been determined that the people best equipped to answer these questions are local people with a First Nations background, who are well respected in their communities. The main problem that arises is that many of these First Nations **contaminants** communicators do not fully understand the research reports, in part because of the nature of the terminology, and also, because information is not available in local languages. If a community member were to ask a question of scientific nature, the communicator would not be able to provide a reasonable answer.

This project looks to provide an understanding of contaminants and contaminants issues through education and communication about the **Northern Contaminants Program (NCP)** and **Canadian Arctic Contaminants Assessment Report II (CACAR II)**. It also looks to improve means of communication through the development of common contaminants terminology in different Aboriginal languages. Regional committee members will meet with their respective communities to develop an appropriate understanding of the research being carried out and define key terms used by the NCP. The community members involved in these small workshops will be asked to discuss and come to an agreement on the Dene Language version and the meaning of the words presented to them.

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TIME FRAME:
April 2005 - March 2006

LOCATIONS OF WORK:
Northwest Territories

SCHEDULE:
For more information on the project, please contact the project leader directly

Participation in the Northwest Territories Environmental Contaminants Committee and Contaminants Language Terminology Development - Deh Cho First Nation

How can communicating contaminant information be improved?

PROJECT SUMMARY:
Many people of the Deh Cho rely heavily on traditional/country foods and in the last five years several studies and projects have taken place that dealt with **contaminants** found in these foods. Communities must understand that the levels of contaminants in their food are very low and that the benefits of eating traditional/country food outweigh the risks. Therefore, clear communication of the **Northern Contaminants Program (NCP)** research results and **Canadian Arctic Contaminants Assessment Report II (CACAR II)** is very important, especially to those communities that have previously received only limited amounts of information. It has recently been stressed in the Denendeh Communication Strategy that oral and visual communication is preferred over written communication. However, if Dene language translators, media and interpreters do not have a sound knowledge of contaminants terminology in their own language, then it is very difficult to communicate even basic information about results from NCP research.

This project will develop a common language terminology and definitions of contaminants-related words commonly used in describing information and project results in the NCP. Each community will be visited to communicate contaminants information in the Deh Cho. and community members will be asked to explain or describe a short list of contaminants words in the slavey language. The Deh Cho will also continue to participate in all scheduled monthly meetings of the NWTECC and all applicable programs available.

LOCATIONS OF WORK:
Deh Cho First Nation

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
April 2005 - March 2006

Participation in the Northwest Territories Environmental Contaminants Committee - Gwich'in Tribal Council

What is the best way to keep Gwich'in communities up-to-date on contaminant information coming out of their communities?

PROJECT SUMMARY:

Gwich'in communities require that information, essential to their understanding of **contaminants**, be continuously provided in a timely manner. The Gwich'in Tribal Council (GTC) acts as a point of contact for community members. Members are able to discuss contaminant issues with members of the committee who provide them with answers or direct them to someone who can. Therefore, maintaining the current level of understanding and participation of the GTC in the Northwest Territories Environmental Contaminants Committee (NWTECC) is very important. Throughout the year, the NWTECC will receive a variety of contaminant related presentations, the information will then be relayed to the members of the GTC as appropriate.

This project will create a distribution list of GTC governments/organizations to ensure all **Northern Contaminants Program (NCP)** and NWTECC communications materials reach appropriate audiences. A GTC representative will be required to participate in NWTECC monthly meetings in order to acquire relevant materials, participate in annual NCP proposal meetings, and review proposals dealing with local contaminants concerns as they are submitted. The GTC representative will also attend the annual NCP results workshop to discuss contaminant issues in the Gwich'in Settlement Area (GSA) with NCP scientists and staff who may be able to help address concerns which have come up.

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TIME FRAME:
April 2005 - March 2006

LOCATIONS OF WORK:
G'wichin Settlement Area

SCHEDULE:
For more information on the project, please contact the project leader directly

Participation in the Northwest Territories Environmental Contaminants Committee and Contaminants Language Terminology Development - Sahtu

How can communicating contaminant information be improved?

PROJECT SUMMARY:

The Sahtu have concerns regarding contaminants in traditional/country foods because they rely heavily on them as part of their diet. They are also concerned as to the effects of the contaminants on animals and the environment. It has been determined, however, that language barriers, remoteness, and the absence of regular community publications hinder the communication of timely information on **contaminants** to the Sahtu people. This project will comply with one of the key activities listed in the Denendeh Communication Strategy through the planning of a language workshop.

This project seeks to develop common terminology wording and descriptions of contaminant words used in the **Northern Contaminants Program (NCP)** in different Aboriginal languages in the Northwest Territories. The regional committee members will meet with their respective communities and develop an appropriate understanding of NCP research results and define key terms. The Sahtu NCP will also continue to participate in the Northwest Territories Environmental Contaminants Committee (NWTECC) in order to obtain the most up-to-date information on contaminants research.

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TIME FRAME:
April 2005 - March 2006

LOCATIONS OF WORK:
Sahtu Settlement Area

SCHEDULE:
For more information on the project, please contact the project leader directly

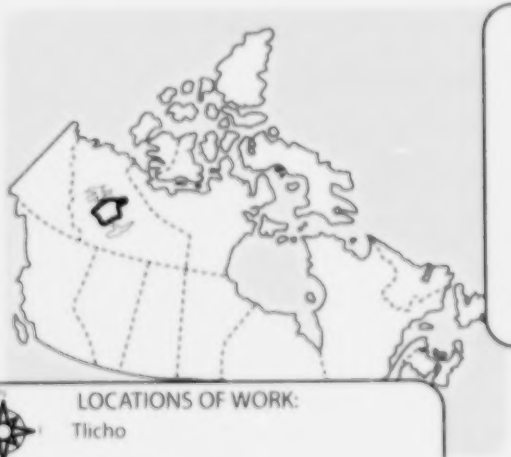
Tlicho Participation in the Northwest Territories Environmental Contaminants Committee and Contaminants Language Terminology Development

How can communicating contaminant information be improved?

PROJECT SUMMARY:

Within the Northwest Territories, the Environmental Contaminants Committee (NWTECC) oversees **Northern Contaminants Program (NCP)** - funded activities. The regional NWTECC representatives have previously, through the use of interpreters and translators, communicated **contaminant** issues to their respective audiences. The message, however, does not seem to be fully understood by community members because the wording used in the translations/interpretations was not exactly correct. It is believed that, by using common definitions in contaminant terminology, communication will vastly improve.

This project will develop a common language terminology and definitions of contaminants-related words commonly used in describing information and project results in the NCP. The first step will be to identify a list of words that need to be clearly defined. Once the list is created, the regional committee members will visit their respective communities to develop an appropriate understanding of the terms and determine appropriate definitions. The Tlicho regional representative will also continue to participate in the NWTECC.



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TIME FRAME:
April 2005- March 2006

LOCATIONS OF WORK:
Tlicho

SCHEDULE:
For more information on the project, please contact the project leader directly

Participation in the Northwest Territories Environmental Contaminants Committee and Contaminants Language Terminology Development - NWT Metis Nation

How can contaminant issues best be discussed with the community members?

PROJECT SUMMARY:

In the past, communication of scientific results from **Northern Contaminants Program (NCP)**-funded projects has not been very good within Aboriginal communities. It is very important that these communities have someone to turn to if they have questions on any issues of concern. Metis members of the Northwest Territories Environmental Contaminants Committee (NWTECC) have since attempted to provide an understanding of **contaminants** and contaminant issues, through education and communication of the NCP and **Canadian Arctic Contaminants Assessment Report II (CACAR II)**. They are currently seeking to improve their communication methods through the development of common contaminant terminology among different Aboriginal languages.

This project will carry out a language workshop, proposed in the Denendeh Communication Strategy. The first step will be to create a list of contaminant terminology used by the NCP that may not be fully understood by community members. Regional committee members will meet with their respective communities to develop an appropriate understanding of the terms on the list and provide definitions for them. The Northwest Territories Metis Nation (NWTMN) will also continue to participate in the NWTECC to gather all necessary information for the community.

LOCATIONS OF WORK:
NWT - Metis Nation

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
April 2005- March 2006

Spatial and Long-term Trends in Persistent Organic Contaminants and Metals in Lake Trout and Burbot from the Northwest Territories

How are contaminant levels in burbot and lake trout in the Northwest Territories changing over time and are there any geographic differences?

PROJECT SUMMARY:

The **Northern Contaminants Program (NCP)** has two main goals under the "Environmental Trends Related to Human Health and International Controls" subprogram. The first goal is to obtain the necessary time trend **contaminant** data to review the success of international controls in reducing contaminant inputs to the North. These assessments will focus on **mercury**, polychlorinated biphenyls (**PCBs**), **DDT**, and **toxaphene**. The second goal of the program is to provide early warning support for the assessment of new contaminants that may become a concern to human health and that could be considered for addition to international agreements. The new contaminants list includes **hexabromocyclododecane (HBCD)**, polybrominated diphenyl ethers (**PBDEs**), **brominated flame retardants (BFRs)**, **perfluorooctane sulfonic acid (PFOS)**, **chlorinated paraffins (CPs)**, and **polychlorinated naphthalenes (PCNs)**. It is important to investigate current concentrations of these compounds and to analyse archived samples to assess temporal trends and inform the assessment of current human dietary exposure.

This project will investigate whether contaminant levels are changing in lake trout and burbot in Great Slave Lake. Great Slave Lake has been chosen for this study because of its extensive historical database and the importance of the fishery. Two different sites have been selected: the West Basin and the East Arm of the lake, because of the different pathways responsible for delivering contaminants. The main focus of the project will be on contaminants such as PCBs, DDT, toxaphene, and mercury; however, new compounds of concern will also be studied. Factors such as length, age, trophic feeding, and lipid levels that affect temporal variability will be closely noted in the fish being studied. Two additional lakes, Cli and Colville Lake, will be studied for mercury concentrations in lake trout. These two lakes have been chosen because of their strong historic data set and because consumption advisories have been issued.

LOCATIONS OF WORK:
1. Great Slave Lake
2. Cli Lake
3. Colville Lake

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
August-November 2005 - sample collection

Temporal Trend Studies of Trace Metals and Halogenated Organic Contaminants, Including New and Emerging Persistent Compounds, in Mackenzie River Burbot, Fort Good Hope, NWT

How are levels of contaminants in burbot changing over time?

PROJECT SUMMARY:

It is believed that rising temperatures associated with global climate change may be contributing to the increasing levels of **mercury (Hg)** in the Mackenzie River valley. Three reasons have been proposed for this observation: a) melted permafrost, increased erosion and forest fires may be releasing increasing amounts of Hg into the river; b) the rate of Hg methylation processes may be increased by increasing temperatures and nutrients; and c) possible changes in food web structure may have an effect on **methylmercury (MeHg) biomagnification**. In the outline for the **Northern Contaminants Program (NCP)** 2005-2006 Call for Proposals it states that the goal for **temporal trend** monitoring is to be able to detect a 10% annual change in **contaminant** concentration over a period of 10-15 years. This requires sample collection and analysis of a minimum of 10 fish annually for a period of 10-15 years. Currently there is minimal or no direct temporal trend information on organochlorine contaminants and heavy metals in fish from Arctic marine or freshwater environments.

This project will maintain current data on contaminant levels in Mackenzie River burbot and will continue to assess the temporal trends of **bioaccumulating** substances such as trace metals, organochlorine contaminants, **toxaphene**, and selected current use chemicals such as **brominated flame retardants (BFRs)**, and fluorinated organic compounds. In December 2005 more burbot will be added to the collection of Fort Good Hope and analysed for the full range of contaminants. This will increase the trace metal data set to 20 years and 10 time points.

LOCATIONS OF WORK:
Fort Good Hope

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
April 2005 - March 2006

Marlene Evans - Spatial and Long-Term Trends in Persistent Organic Contaminants and Metals in Lake Trout and Burbot in Great Slave Lake, NT

What and Where:

Lake trout and burbot were collected from the East Arm and West Basin of Great Slave Lake in 2004. Samples of trout and burbot muscle and bubot liver were analyzed for **mercury** and **persistent organic pollutants (POPs)**.

Top Three Findings:

1. There is evidence that **organochlorine (OC) contaminant** levels declined in lake trout from 1993-2002. No such trend is apparent for burbot. **PCB** and **DDT** concentrations in burbot from the West Basin show some evidence of a slight temporal increase.

2. Mercury concentrations in lake trout and burbot in the early 2000s are similar to concentrations observed in the late 1970s and early 1980s. However, concentrations may be greater than observed in the early to mid 1990s.

3. Mercury concentrations are, on average, below the 0.2 ug/gm guideline for frequent consumers of fish.

Importance of the Results:

The results of this project are starting to reveal some temporal trends that indicate input of POPs from long range atmospheric transport may be declining. The evidence for this is in the declining POP concentrations measured in lake trout. It is interesting to note that burbot, which are bottom dwelling fish, do not exhibit the same trend. This is consistent with results obtained from Lake Laberge burbot. While the results for mercury do not show any substantial decreases in concentration, they do indicate that the average mercury levels in fish muscle are below the guideline for frequent consumers of fish.

Future Activities:

As part of the Environmental Trends Monitoring Plan, Lake trout from the East Arm and West Basin of Great Slave Lake will be collected annually to help improve our interpretations of the **temporal trend**. In 2005, Trout will also be collected from Cli and Colville lakes.

NWTECC - Completing Regionally Relevant Health Risk Assessments for Mercury Levels in Fish in Northwest Territories Lakes and Rivers

What and Where:

The Northwest Territories Environmental **Contaminants** Committee (NWTECC) undertook this project to ensure health risk assessments (HRAs) and current health advisories for **mercury** levels in fish in NWT lakes and rivers are relevant to the residents of the NWT. Using regional average dietary intake levels, estimates of mercury exposure were calculated and compared to Canadian guidelines. Several scenarios were presented for average fish consumers and high-end consumers using mean and maximum mercury values, by gender and age groups.

Top Three Findings:

1. The fish intake rates calculated by Centre for Indigenous Peoples Nutrition and the Environment (CINE) indicate that many meals of fish can be consumed numerous times per week without risk of exceeding guideline levels of mercury exposure. In particular, whitefish and Arctic char can be consumed in large quantities without concern.

2. Exposure estimates using the average fish consumption rates for regional gender-age groups, and either the mean or maximum mercury concentrations in fish showed that no groups exceeded the mercury intake guideline levels.

3. Local traditional knowledge needs to be incorporated into the discussion about HRAs, and decisions should be made only after taking into consideration current dietary patterns and traditional harvest patterns. The outcome will be collaborative risk management decision making.

Importance of the Results:

Following fourteen years of research, the **Northern Contaminants Program (NCP)** has provided northerners with a valuable balance of human health, environmental trends and education/communication research pertaining to long-range contaminants in the North. It is timely in the NWT that health advice on fish consumption due to mercury be revisited considering the current focus of the NCP on mercury.

It is important to note that no gender or age groups exceeded the mercury intake guideline levels. This result should ease some concerns in the NWT regarding the mercury levels found in fish.

Gary Stern - Temporal Trend Studies of Trace Metals and Halogenated Organic Contaminants (HOCs), Including New and Emerging Persistent Compounds, in Mackenzie River Burbot, Fort Good Hope, NWT

What and Where:

Tissues from burbot were collected at Fort Good Hope (Rampart Rapids) in December 2004 and were analysed for organohalogen **contaminants** (**OCs**, **PCBs**, **BFRs**, **PFCs**) and **heavy metals** (**mercury**, **selenium**, **arsenic**).

Top Three Findings:

1. Mean wet weight mercury (Hg) concentrations in muscle from male Fort Good Hope burbot have almost doubled over the 19-year time period from 1985 to 2004.

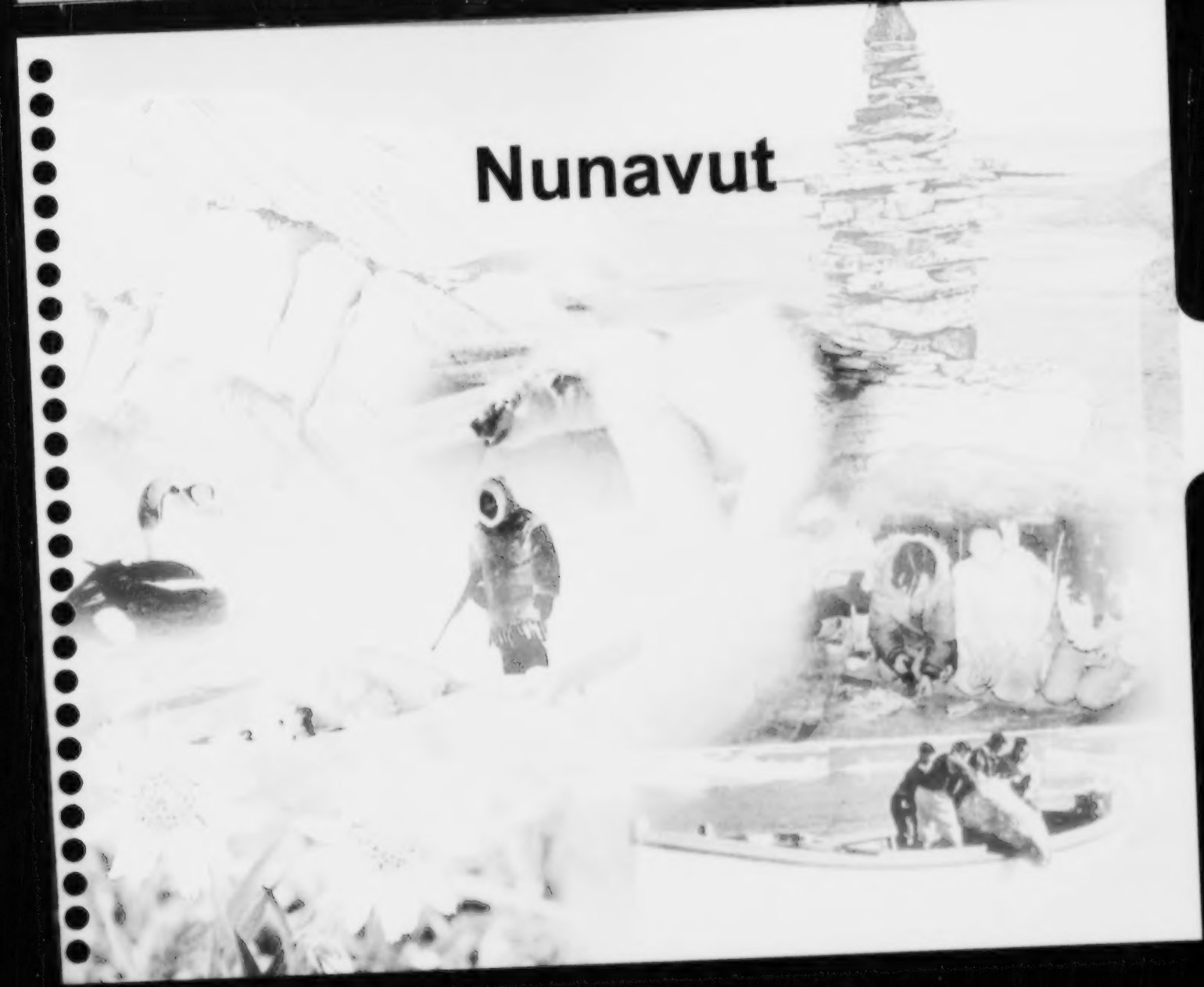
2. Muscle mercury levels are below the recommended guideline level for commercial sale but are at, or exceed, the guideline level recommended for fish used for subsistence.

3. Brominated flame retardants (BFRs) such as **PBDEs** have increased 3.6-15.1 fold over the 19-year period from 1988 to 2004. However, these chemicals are still about one tenth PCB levels.

Importance of the Results:

In the Mackenzie Basin over the last 150 years a steady increase in temperature has been recorded. In particular, over the last 35 years temperatures have increased about a degree a decade in the centre of the basin. Rising temperatures in the region may be responsible for the increasing mercury levels in burbot from Fort Good Hope for several reasons: (a) melted permafrost, increased erosion and forest fires may be releasing increasing amounts of Hg into the river; (b) the rate of Hg methylation processes may be increased by increasing temperatures and nutrients, particularly in the wetlands and peatlands in the basin; and (c) possible changes in **food web** structure may have an effect on **methylmercury** (MeHg) **biomagnification**.

Nunavut



Nunavut

Monitoring Temporal Trends of Human Environmental Contaminants in Nunavut

How are levels of contaminants changing in the blood of pregnant women in Nunavut?

PROJECT SUMMARY:

Between 1994-1999 a territorial baseline of selected **organochlorine** and metal **contaminants** in maternal and cord blood was established for Nunavut. This region was specifically chosen because of the higher levels of contaminant exposure (Baffin) in comparison to other places. Currently the program aims to establish **temporal trends** of selected environmental contaminants in human blood and hair. The data obtained from this research will provide data to international contaminant monitoring initiatives such as the Global Monitoring Plan under the **Stockholm Convention**.

This project will recruit approximately 100 pregnant women from the Baffin region of Nunavut. Participants will be interviewed prior to delivery to assess diet and lifestyle during pregnancy, and blood and hair samples will be taken for further analysis. Communication networks will be established with interested parties such as hospital staff, community health centre staff, and Aboriginal organizations. Materials will also be developed for ongoing communication of program activities to the communities involved. Temporal trends will be evaluated for selected organochlorines and metal contaminants providing updated geographic patterns of exposure and dietary habits. A relationship between contaminant exposure and frequency of consumption of traditional/country foods and selected lifestyle factors will also be established.

LOCATIONS OF WORK:
1. Baffin Island, Nunavut
2. Laval, Quebec
3. Ottawa, Ontario

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
April 2005 - the Coordinator will be trained

June 2005 - participant recruitment will begin

June/July 2005 - joint meeting with the research team and Coordinators from both Baffin and Inuit regions

Ongoing - sample analysis and data input

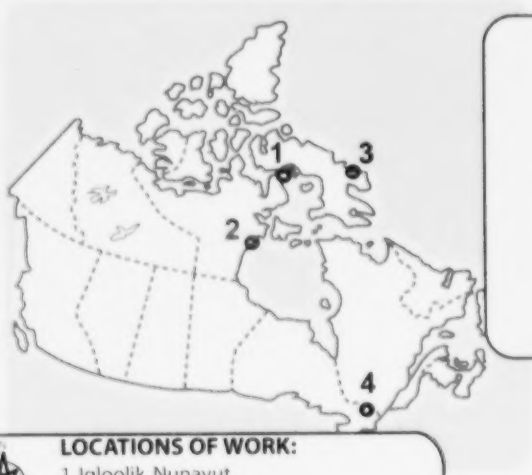
Estimation of Dietary Exposure to Perfluorinated Carboxylates and Sulfonates via Consumption of Traditional Foods

What are the levels of new contaminants in Inuit traditional/country foods?

PROJECT SUMMARY:

Perfluorinated acids (PFAs) are a class of emerging contaminants that has been highlighted in the **Northern Contaminants Program (NCP)** Blueprint for Human Health. PFAs are widely used in commercial and industrial applications such as cosmetics, fire fighting foams, and water and grease repellent coating for fabrics and food packaging. Recent research has shown that these compounds are **persistent** and **bioaccumulative** global **contaminants**. Some laboratory studies have demonstrated that certain PFAs may cause **cancer** or promote the formation of tumours. Past research has also shown that these PFAs, or related compounds, are transported to the Arctic through long-range atmospheric transport, and accumulate in animals such as beluga, ringed seal, narwhal, and Arctic cod. There is a need to monitor **temporal trends** of contaminant levels in traditional/country foods.

This project will measure the concentrations of a series of new chemical contaminants in traditional/country foods, mainly PFAs. Seventy samples collected from Nunavut between 1997-1999 will be analysed for eight perfluorinated carboxylates and two perfluorinated sulfonates. The majority of the archived samples are frequently consumed items such as caribou and seal meat, fish, and narwhal muktuk. The dietary intake of PFAs for Nunavut populations will be estimated from data on the consumption of traditional/country foods and the PFA concentrations in foods. An important fact is that not all traditional/country foods are eaten raw; some are boiled, roasted, or dried. Preparation methods may affect PFA concentrations (as is also the case for some other contaminants). To address this knowledge gap PFAs will be measured in food samples prepared in a variety of traditional ways.



LOCATIONS OF WORK:
1. Igloolik, Nunavut
2. Chesterfield Inlet, Nunavut
3. Qikiqtarjuaq, Nunavut
4. Ottawa, Ontario

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
April 2005-March 2006 - Analysis of archived food samples

Dietary Exposure of Inuit Communities to the Brominated Flame Retardants (BFRs) Polybrominated Diphenyl Ethers (PBDEs) and Hexabromocyclododecane (HBCDD)

What are the levels of brominated flame retardants found in traditional/country foods in Nunavut?

PROJECT SUMMARY:

Research has shown that over 90% of northerners' exposure to **persistent organic pollutants (POPs)** occurs through their food intake. Currently there is little information available on human exposure to **brominated flame retardants (BFRs)**, especially polybrominated diphenyl ethers (**PBDEs**) and **hexabromocyclododecane (HBCD)**, from food in the Northern region. BFRs are a diverse group of chemicals that are added to manufactured products such as polymers, plastics and textiles to reduce their flammability. It is very important that this information be gathered to carrying out health risk assessments.

This project will obtain comprehensive exposure information and risk assessment parameters on POPs through the analysis of archived traditional/country foods from Nunavut communities. One hundred and twenty previously collected samples will be analysed for BFRs, PBDEs, and HBCD. The intake levels of these POPs will be estimated by combining the levels found in food with the daily intake of each individual. The analytical data will be merged with the dietary information already available from community specific data to generate site specific estimates. The risk of exposure will be determined through this research and the results will be communicated to the communities of Nunavut.

LOCATIONS OF WORK:
1. Nunavut
2. Burlington, Ontario

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
April 2005-March 2006 - Analysis of archived food samples

Factors Influencing Food Choices among Women and Men Living in Kinngait (Cape Dorset), Nunavut

What are the main factors that affect people's choice of foods?

PROJECT SUMMARY:

It is well documented that traditional/country foods are an important source of healthy fats, vitamins, minerals, and protein. A decrease in the consumption of traditional/country foods has been associated with an increase of total fat, saturated (less healthy) fat and sugars from store-bought food. These increases can cause negative health effects such as obesity, diabetes, anaemia, infections, and **cancer**. It has been shown that the factors influencing food choices are related to the social and cultural aspects of everyday life. **Contaminants** found in traditional/country foods have may be one of several factors behind people's food choices. However, these factors must be better understood in order to develop effective public health policies and effective benefit-risk communication.

This project will focus on investigating the factors that influence the food choices of women and men. A random selection of individuals will be interviewed to obtain a representation of the community perspectives on food choices. The factors are organized into four decision-making categories: culture-based; knowledge-based; resource-based; and physical health-based. From the research a new problem-solving tool will be developed in order to understand better the determinants of individual food choices. It will also be important to develop a deeper understanding of the relationship between food choices, environmental opportunities, and Inuit culture. This research will aid Aboriginal organizations and northern public health officials in planning effective risk reduction strategies to effectively target specific population groups based on dietary behaviours.

LOCATIONS OF WORK:
Cape Dorset, Nunavut

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
April 2005-March 2006

Understanding Communications on Contaminants: A Case Study Review of Lessons Learned in the Canadian North

How well do people understand the information they are given on contaminants?

PROJECT SUMMARY:

For several years it has been known that the levels of **contaminants** in some traditional/country foods are high enough to raise concerns about human health. It is also recognized that those local foods are important to people; therefore, it is important to have proper means of communicating scientific results to the communities. For the past two years a communication survey was taken in communities in Labrador, Nunavik, Nunavut, and the Inuvialuit Settlement Region (ISR). Results showed that some people have not heard of the issue of contaminants, which clearly shows gaps in the current communication packages. It is important to figure out why these gaps exist and how they can be fixed.

This project will select, document, and review at least one communication event in one community in each region of the Canadian North. Personnel will be trained to conduct the research and evaluation of the studies. They will assess the recall of the message and identify the factors at the community level that influence the outcome. The survey questionnaire will be standardized for the purpose of comparability but some regional flexibility will be allowed. The questions will assess awareness, comprehension, recall and perception of risk related to the individual. Information gained from the case studies will be used to recommend improvements to the communication processes.

LOCATIONS OF WORK:
1. Nunavut
2. Labrador
3. Nunavik
4. Inuvialuit Settlement Region

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:

June 2005 - identification of regional case studies

July 2005 - Report of workshop 1

Feb 2006 - summary reprot of case studies and basic data collected

June 2006 - Report of workshop 2

Sept/Oct 2006 - Regional case study reports
- National level report

Inuit Communications at a National Level

What is the most effective way to relay information to Inuit communities?

PROJECT SUMMARY:
Traditional/country food is central to cultural and personal well-being in Inuit regions making the management and communication of the risk posed by environmental **contaminants** in the **food chain** a very challenging issue. The **Northern Contaminants Program (NCP)** has increased its focus on these regions in order to investigate and identify the impacts of contaminant exposure on health. In the past, communication efforts have involved developing different products including posters, websites, education curricula, newsletters, etc. The focus has since been aimed at coordinating communication activities, bringing together the Inuit regions, and educating scientists about consultation and communication concerned with Arctic research. As the NCP evolves into a new phase of activities there is a need to develop regional and national long-term strategies for communication.

This project will conduct work to identify appropriate national and region-specific pathways for the dissemination of contaminants messages and general information. The goal will be to identify and utilize the associated formal and informal pathways for communicating contaminants information in context. A pan-Inuit committee will be created as a mechanism for on-going exchange of contaminants communication issues in the North among national, international and regional Inuit organizations. Lastly, the 2003-2004 Inuit-wide communications survey will continue to be analysed and a general Inuit communications package will be developed.

LOCATIONS OF WORK:
1. Nunavut
2. Labrador
3. Nunavik
4. Inuvialuit Settlement Region

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
April 2005 - March 2006

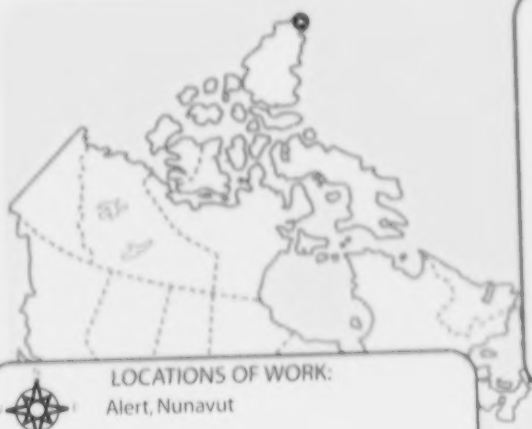
Northern Contaminants Air Monitoring: Organochlorine Measurements

How are atmospheric concentrations and deposition of priority pollutants in the Arctic changing?

PROJECT SUMMARY:

The primary pathway for **organochlorine (OC) contaminants** to enter the Arctic ecosystem is through atmospheric currents. Measurements of organochlorines and **polycyclic aromatic hydrocarbons (PAHs)** in Arctic air have been ongoing since 1992, and have become a key part of the long-term monitoring program under the **Northern Contaminants Program (NCP)**. The information collected through this research has been used to negotiate international control agreements, such as the **Stockholm Convention**, and is currently being used to evaluate their effectiveness. Declining trends in many legacy **persistant organic pollutants (POPs)** are a good indication that international controls can effectively result in decreased input of contaminants to the Arctic. Evidence of new POPs in Arctic air will be critical for having these substances added to the Convention in the future.

This project has two main objectives: routine air monitoring of POPs and monitoring for new and emerging chemicals in Arctic air. The first will involve collecting weekly samples of particulate matter and gases and analyzing them for OCs, **PBDEs**, and PAHs. A site audit will also be carried out this year to ensure that the sampling operation has been and will continue to be properly conducted. The second part of the project involves investigating the occurrence of emerging chemicals, such as **polychlorinated naphthalenes (PCNs)**, current-use **pesticides**, **brominated flame retardants (BFRs)** and perfluorinated compounds. Last year 14 polybrominated diphenyl ethers (PBDEs), **endosulfan** II, and 2 methyl-naphthalenes were added to the chemical list. As new emerging chemicals are continually being added to the chemical list it is vital that new procedures used in their analysis be developed to ensure conventional chemical analysis is not compromised.



LOCATIONS OF WORK:
Alert, Nunavut

SCHEDULE:
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TIME FRAME:
April 2005-March 2006 - Samples are collected year round at Alert.

Air Measurements of Mercury at Alert

How does mercury reach the Arctic ecosystem and what are its atmospheric time trends?

PROJECT SUMMARY:

Mercury (Hg) is a high priority **contaminant** found at elevated levels in aquatic and marine animals in the Arctic. Its sources can include **anthropogenic** or natural contributions. Elemental mercury can remain in a vapour state for long periods of time but mercury that is found on particles or as a reactive gas has been shown to rapidly deposit onto snow and ice. The oxidation of gaseous elemental mercury into reactive gaseous mercury and particulate mercury has been shown to occur during polar sunrise in the Arctic spring. These mercury depletion events (MDEs) increase total mercury concentrations in the snow. The mercury that deposits onto snow and ice can eventually enter the **food chain** and traditional/country foods. The data provided from this study will aid in understanding the impact of atmospheric mercury in the Arctic ecosystem and ultimately its effects on human health.

This project will determine if concentrations of mercury in air, on particles and in snow at Alert are increasing or decreasing with time. Measurements will establish temporal trends in atmospheric mercury concentrations and deposition processes of mercury in the Arctic. Between February and June, snow and water samples will be collected at Alert to test for their Hg content. Snow will be collected in two different forms: freshly fallen snow and deposited surface snow. The water will be collected from nearby lakes and tributaries. This work will allow the continued collaboration with international researchers in collecting, understanding and interpreting mercury measurements at several Arctic sites.

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LOCATIONS OF WORK:
Alert, Nunavut

SCHEDULE:
For more information on the project, please contact the project leader directly

TIME FRAME:

April 2005 - continue measurements at Alert

June 2005 - present results from this program at the International Conference for Heavy Metals, Rio de Janeiro

July 2005 - complete snow sampling at Alert

2005/2006 - peer-reviewed journal publications

Temporal Trends of Persistent Organic Pollutants and Metals in Ringed Seals from the Canadian Arctic

Are the concentrations of key contaminants in ringed seals changing over time?

PROJECT SUMMARY:

One of the goals for the **Northern Contaminants Program (NCP)** monitoring program is to establish reliable **temporal trends** for **mercury**. Temporal trend information is important for all **contaminants** in the Arctic so that the effectiveness of international controls can be assessed. This data will also provide valuable information needed to assess trends in dietary contaminant exposure among northerners.

This project will determine changes in concentrations of contaminants, such as **PCBs**, other **persistent organic pollutants (POPs)**, and mercury in ringed seals. Annual sampling at Sachs Harbour, Resolute, and Arviat, will be carried out in order to improve the ability to detect changes in concentrations over time. Sampling on a five-year cycle will continue in 10 other communities, with two communities visited per year. This year the sampling will be carried out at Nain, and Qikiqtarjuaq. Trends in the concentration of POPs will be studied from the blubber samples of female seals, while mercury and other **heavy metal** trends will be studied in the liver and kidneys of both male and female seals. All the tissues that are not analysed in this project will be kept for future use.

LOCATIONS OF WORK:
1. Resolute, Nunavut
2. Qikiqtarjuaq, Nunavut
3. Nain, Labrador
4. Arviat, Nunavut
5. Sachs Harbour, NWT

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
April 2005-March 2006

Time Trends on Hendrickson Island Beluga and Spatial-Trend Studies on Hendrickson Island, Kimmirut, Arviat, Sanikiluaq and Pangnirtung Beluga for New and Emerging Persistent Halogenated Compounds

Has there been any change in the concentration of new contaminants found in beluga and are there differences in concentration between different locations?

PROJECT SUMMARY:

In the last twenty years marine mammals have been used to determine levels of **contaminants** in the Arctic. The studies have shown that temporal changes in the emissions of chemicals into the environment are reflected in contaminant levels measured in the animals from affected **ecosystems**. The results of these tests have also displayed geographical differences in the amounts of chemical contaminants. Results can be used to assess the sufficiency of international controls, thereby contributing to the fulfilment of Canada's obligation to scientifically support international conventions on **persistent organic pollutants (POPs)**. Measurements of new contaminants will provide an early warning for the assessment of human health risks and will provide valuable evidence in support of expanding international agreements. Results will also be used by the **Northern Contaminants Program (NCP)** to update the long-term monitoring strategy.

This project will involve beluga from Kimmirut, Arviat, and Sanikiluaq to test for any geographical differences in the concentration of new and emerging organohalogen contaminants. It will also look at temporal changes in the amounts of emerging organohalogen contaminants in blubber and liver of beluga from Hendrickson Island. 'Hot-spots' will also be clearly identified and closely observed. Through this research, the project hopes to fill in any knowledge gaps about new contaminants identified by the NCP.

LOCATIONS OF WORK:
1. Hendrickson Island, NWT
2. Kimmirut, Nunavut
3. Arviat, Nunavut
4. Sanikiluaq, Nunavut
5. Pangnirtung, Nunavut

SCHEDULE:
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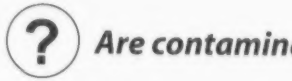
TIME FRAME:
April 2005-March 2006

Temporal Trends of Heavy Metals and Halogenated Organic Compounds in Arctic Marine Mammals (Beluga, Narwhal, and Walrus)



Are contaminant levels in marine mammals changing over time?

PROJECT SUMMARY:

Previous studies have determined that the levels of **mercury** in the tissues of northern marine mammals generally exceed the guidelines used to regulate the sale of, or develop advice for, domestic consumption of fish. Studies have also shown that about half of the mercury entering the Arctic is **anthropogenic** in nature. Recent research activities have been used to determine **temporal trends** of contaminant levels. These studies have noted that the levels of major halogenated organic compound (HOC) groups, such as **hexachlorocyclohexane (HCH)**, **DDT**, **chlordane**, and **toxaphene** have declined; however, currently used **pesticides** such as **endosulfan** may actually be increasing. The accumulation of data resulting from these studies have offered means to detect both spatial and temporal trends of HOCs and heavy metals in marine mammals across Canada.

This project will continue to assess long-term trends and maintain the current data base of levels of **bioaccumulating** substances such as **heavy metals** and halogenated organic compounds in beluga, narwhal and walrus. This will require that annual temporal tend studies of heavy metals such as mercury, **methylmercury**, and HOCs in beluga, narwhal and walrus are carried out. Many of the samples that will be analysed this year have been collected in previous years and will provide a better picture of the temporal trends taking place. Narwhal will be collected this year from Pond Inlet, Broughton Island, and Arctic Bay. Walrus collection will take place in Igloolik, Cape Dorset, Inukjuaq, Coral Harbour, and Grise Fiord. Beluga collections will occur in Hendrickson Island, Sanikiluaq, Pangnirtung, Igloolik, and Iqaluit.

LOCATIONS OF WORK:

1. Pond Inlet, Nunavut
2. Broughton Island, Nunavut
3. Arctic Bay, Nunavut
4. Igloolik, Nunavut
5. Cape Dorset, Nunavut
6. Hendrickson Island, NWT
7. Sanikiluaq, Nunavut
8. Pangnirtung, Nunavut
9. Iqaluit, Nunavut
10. Inukjuaq, Nunavik
11. Coral Harbor, Nunavut
12. Grise Fiord, Nunavut

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
July 2005 - collection of new marine mammal samples

Temporal Trends of Contaminants in Arctic Seabird Eggs: Inter-Year Variability

How are the levels of contaminants changing over time in seabird eggs on Prince Leopold Island?

PROJECT SUMMARY:

Since 1975, **contaminants** have been monitored in Arctic seabird eggs collected from Prince Leopold Island. Collection of eggs as an index of contaminant levels in birds was chosen as a non-intrusive way of obtaining information. The data has shown a decline in most of the **organochlorines (OC)** as well as **dioxins** and **furans**. Contaminants such as **hexachlorocyclohexanes (HCH)**, polybrominated diphenyl ethers and **mercury,** however, have been increasing, and the presence of new chemicals has been confirmed. It is very important that researchers are able to maintain and improve their ability to detect changes in the **bioavailability** of these compounds. Like other Environmental Trends projects, this project has incorporated **power analyses** into the sampling program design in order to describe the **statistical power** of trends measured in eggs of thick-billed murres and northern fulmars.

In order to examine the inter-year variation in contaminant data and improve the statistical power of the **temporal trend** data series for Canadian Arctic seabirds, this project will collect eggs from two species of seabirds (northern fulmar, thick-billed murre) from Prince Leopold Island annually for five years starting in 2005. Fifteen eggs will be collected on the basis of one egg per nest for each of the two species. Eggs from thick-billed murres on Coats Island will also be collected this year. Murre and fulmar eggs from Prince Leopold Island will be analysed for a variety of different **persistent organic pollutants (POPs)**. In order to evaluate the potential effect of changes in seabird diet on the temporal trends observed for contaminants all the eggs will be analysed individually for stable **isotopes**.

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TIME FRAME:
April 2005- March 2006

LOCATIONS OF WORK:
1. Prince Leopold, Nunavut
2. Coats Island, Nunavut

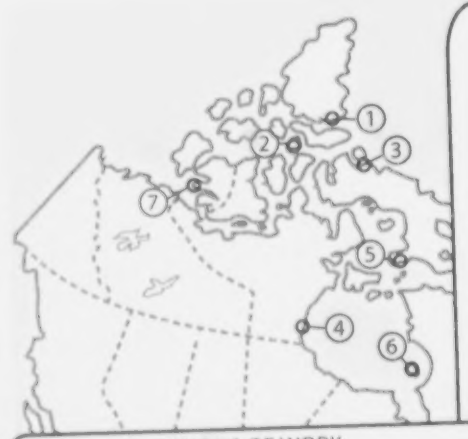
SCHEDULE:
For more information on the project, please contact the project leader directly

Temporal Trends and Spatial Variations in Persistent Organic Pollutants and Metals in Sea-run Char from the Canadian Arctic

What are the levels of contaminants in sea-run Arctic char from various Arctic communities and how do they compare with landlocked Arctic char?

PROJECT SUMMARY:
Starting in 1993, research and monitoring studies determined that levels of **mercury** and organic **contaminants** were relatively high in the diets of Arctic residents. Of greatest concern are high levels of contaminants such as **PCBs**, **toxaphene**, **DDT**, and mercury found in marine mammals that make up an important part of the Inuit diet. Unlike marine mammals, it has been observed that sea-run Arctic char have relatively low contaminant levels, although data is quite limited and only available for Nunavik and Labrador. Since char is also very nutritious, it is being promoted as a healthy food choice for Inuit, particularly young women.

This project will investigate contaminant levels along a north-south gradient from southern Hudson Bay to Ellesmere Island. Six communities (Grise Fiord, Resolute, Pond Inlet, Cape Dorset, Arviat, and Sanikiluaq) will be chosen as locations to test for contaminant levels in char. Char will be tested for **persistent organic pollutants (POPs)** and **heavy metals**, as well as new potential POPs. Spatial gradients of these contaminants will be investigated and compared with results for landlocked char. The factors affecting contaminant levels in both sea-run and landlocked char will also be explored.



LOCATIONS OF WORK:
1. Grise Fiord
2. Resolute,
3. Pond Inlet
4. Cape Dorset
5. Arviat
6. Sanikiluag
7. Holman

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
August 2005 - sample collection in the communities

Temporal Trends of Persistent Organic Pollutants and Mercury in Landlocked Char in the High Arctic

How are levels of POPs and mercury changing over time?

PROJECT SUMMARY:
Top predators in Arctic lakes, such as landlocked Arctic char, are good indicators of change in levels of **methylmercury (MeHg)** and **persistent organic pollutants (POPs)** due to the effects of **biomagnification** of these **contaminants**. These and other pollutants enter the Arctic atmosphere on air currents and can then be passed to lakes by snow and rain. An increase in precipitation has been shown to increase the input of contaminants of Arctic lakes. Climate warming and the destruction of the ozone layer may also increase input of contaminants to Arctic lakes. Other effects of climate change may increase the occurrence of mercury depletion events (MDEs), which could also increase the amount of mercury deposited in Arctic lakes.

This project will investigate changes in concentrations of contaminants over time in landlocked Arctic char from lakes in Nunavut. Pollutants such as POPs and **mercury** will be measured yearly in fish from Resolute, Char, and Amituk Lake, in order to determine if levels are increasing or decreasing. The fish will be selected for consistency based on sex, age, size, and sampling season. Sediment and water collections will also be taken for potential analysis. The ultimate objective of this project will be to develop **temporal trends** over a 12-15 year period for **PCBs** and **organochlorine (OC) pesticides**/byproducts, as well as trends for **PBDEs** in char.

LOCATIONS OF WORK:
1. Resolute Lake
2. Char
3. Amituk Lake

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:

July-early August 2005 - presentations to the Resolute Bay Hamlet council

May 2006 - final report given to the NCP

Birgit Braune - Time-Trend Studies on New and Emerging Persistent Halogenated Compounds in Marine Mammals from the Canadian Arctic

What and Where:

New chemicals (e.g. **brominated flame retardants (BFRs)**, chlorinated naphthalenes (**PCNs**) and perfluorinated acids (**PFAs**)) were analyzed in archived egg and liver samples of thick-billed murres and northern fulmars collected from Prince Leopold Island in Nunavut. Samples used in this study were collected between 1975 and 2004.

Top Three Findings:

1. The study contributes the first set of information on **temporal trends** of hexabromocyclododecane (**HBCD**, a brominated flame retardant), the PFAs (fluorinated chemicals related to **PFOS**) and the PCNs (similar to **PCBs** and produced during combustion) in Arctic seabirds.

2. Total polybrominated diphenyl ethers (**PBDEs**) and HBCD have increased significantly in northern fulmars over the last 2-3 decades, whereas in thick-billed murres, only PBDEs increased significantly.

3. Perfluorinated acids have increased over the last three decades in thick-billed murres, whereas in the northern fulmars, the trend is less clear.

Importance of the Results:

These results indicate that the levels of some new chemicals (e.g. perfluorinated compounds, brominated flame retardants) are increasing in Arctic biota. These compounds are likely passed on to humans through the traditional/country foods that they eat. While the levels are still quite low compared to other **persistent organic pollutants (POPs)**, it is important to report these results to the international community. These results help to demonstrate that these new chemicals behave just like the POPs that are now banned under the **Stockholm Convention**. With results like these we can help build a case to have these new chemicals considered POPs and have them added to the Stockholm Convention.

Janet Brewster - Monitoring Temporal Trends of Human Environmental Contaminants in the NWT and Nunavut

What and Where:
This project aims to establish **temporal trends** of selected environmental **contaminants** in human blood and hair in Nunavut. This program was initially proposed as a three year program, but delays in getting coordinators in place and getting the program up and running in 2004 have extended the program to run over four years.

Top Three Findings:
Due to delays, there are no results yet from this project, but some important milestones were met in the 2004-2005 fiscal year:

1. Work completed in 2004 focused on hire of a regional coordinator, ethics approvals, finalization of the maternal interview questionnaire and dietary survey, and approval of the consent form.

2. The project received ethical approval from the Nunavut Health and Social Research Ethics Committee and the Laval University Ethics Committee

3. A Coordinator was hired in March 2005.

4. Development of communication materials and protocols is ongoing in preparation for recruitment and sampling to begin in Fall 2005.

Importance of the Results:
When this study does yield results, they will be important because they will give a picture of the level of contaminants found in the people of Nunavut. Contaminants can be found in every person in the world, but this study will give Nunavut-specific information.

Laurie Chan - Managing the Issue of Mercury Exposure in Nunavut: A Pilot Study

What and Where:
This study took place 2 years ago. Using food frequency surveys, samples of traditional/country foods, and hair samples (given voluntarily) in Igloolik and Repulse Bay, this study attempted to look at the potential risk of **mercury (Hg)** to the health of the two communities' populations.

Top Three Findings:
1. The most consumed species in Igloolik were caribou, ringed seal, walrus and char. In Repulse Bay, the most consumed species were caribou, ringed seal, walrus, and narwhal.

2. There is a significant correlation between Hg in hair and both traditional/country food intake and estimated Hg intake in the two communities.

3. Some community members from Igloolik and Repulse Bay had mercury levels above Health Canada's level of minimal concern. However, the average level of mercury in the hair of the population was below the low risk level.

Importance of the Results:
This study is important because it demonstrates that there are numerous ways in which you can estimate the levels of mercury in a group of people. Additionally, it is important to note that for some people in these communities, mercury is above the level of minimal risk. This means that mercury should continue to be monitored, to determine if levels are increasing or decreasing in northern peoples.

Marlene Evans - Temporal Trends and Spatial Variations in Persistent Organic Pollutants and Metals in Sea-Run Char from the Canadian Arctic

What and Where:

Arctic char were collected near the communities of Paulatuk, Holman, Cambridge Bay, Gjoa Haven, Iqaluit, and Pangnirtung. Samples of char muscle were analyzed for **persistent organic pollutants (POPs)** and **heavy metals**, including **mercury**.

Top Three Findings:

1. Mercury levels in sea run char were very low and comparable to whitefish in the Northwest Territories

2. Mercury concentrations were substantially lower in sea-run char than in land-locked char.

3. There were no significant differences between the mercury levels in char from the different communities that participated in the study.

Importance of the Results:

These results provide the most up to date information about **contaminant** levels in Arctic char. The low levels of mercury reported by this project confirm that contaminant levels in sea-run char are very low. This is very important news since Arctic char is being promoted as a nutritious traditional/country food.

Future Activities:

As part of the Environmental Trends Monitoring Plan, Arctic char will be collected from several more communities from the high Arctic to southern Bay during the summer of 2005.

Hayley Hung - Passive Air Sampling for Persistent Organic Pollutants (POPs) in Cold Environments

What and Where:

A passive air sampler is being designed by the Meteorological Service of Canada (MSC) and the University of Toronto that can sample **persistent organic pollutants (POPs)** in air without the need for electricity and frequent maintenance. New samplers are being tested at Alert, Nunavut.

Top Three Findings:

1. A newly designed passive air sampler has been built and tested in the South.

2. This passive air sampler is designed such that it can sample air for the measurement of persistent organic pollutants (including **PCBs**, **pesticides**, and industrial and combustion by-products) in Arctic air without the supply of power and the attention of an operator. The cost of operating such a passive air sampler will be much lower than the traditional method of using an air sampler which pumps air through a filter.

3. This means that we can place these samplers at many different remote locations to determine if there is a difference in levels of pollution in different parts of the Arctic. We can then figure out where these pollutants come from and what influences their entry into the different parts of the Arctic.

Importance of the Results:

Air is known to be the most important route of entry for POPs into the Arctic environment. It is, therefore, important to monitor the air. Unfortunately the traditional method of sampling air is very expensive and it is not possible to sample air at a lot of different locations in the Arctic. The Arctic is a very large region and the geography, climate, movement of air and human activities differ from one part of the Arctic to another. These differences affect the entry of pollutants into the Arctic **ecosystem**. With the newly designed passive air sampler which is much cheaper and easier to operate than the traditional method, it is possible for us to measure the air concentrations of POPs at multiple locations. This will allow us to trace the sources of these pollutants and determine what influences their movement into the different parts of the Arctic.

Future Activities:

The project leaders continue to work on developing an Arctic-ready Passive Air Sampler, although this research is being funded by another agency for the next year. Once the sampler is ready for Arctic use it may appear in future **Northern Contaminants Program (NCP)** projects.

Robert Letcher - Temporal and Spatial Trends of Contaminants in Canadian Polar Bears, Part II

What and Where:
Samples of liver and fat of polar bears from populations spanning the western hemispheric Arctic in Alaska, Canada, Greenland and Svalbard (Norway), were collected between 2001 and 2002. These samples were analyzed for **persistant organic pollutants (POPs)** and **heavy metals** as well as new **contaminants** that have rarely been measured in polar bears before.

Top Three Findings:
1. New contaminants, including **brominated flame retardants (BFRs)** and **perfluorinated compounds (PFCs)**, were measured in fat and liver of polar bears from all Arctic locations.

2. Levels of **PFOS**, the most abundant PFC, increased between 1972 and 2002 with levels doubling every 13 years in the Western Arctic.

3. Concentrations of PFOS were highest among bears from southern Hudson Bay and East Greenland which indicates that the main sources of PFOS are in Eastern North America and Western Europe and that levels in the Arctic are a result of atmospheric transport.

Importance of the Results:
Earlier results that were generated by the **NCP** about the levels of POPs in the Arctic were very important for negotiating international agreements such as the **Stockholm Convention** on POPs. This convention eliminates, or seriously restricts the use of POPs in countries around the world and by doing so will reduce the amounts of contaminants reaching the Arctic. Now that that this convention has entered into force, it is important to continue monitoring Arctic wildlife to see if contaminant levels go down. It will also be important to look for any new contaminants entering the Arctic environment and to assess the need for having them added to the Stockholm Convention. Polar bears are the top predator in the Arctic and have become an international symbol of the Arctic environment. Since they are at the top of the **food chain**, polar bears can also accumulate very high levels of POPs. The results of the project are important because they show that the levels of most legacy POPs are not getting any higher, and may actually be decreasing. This project has also shown that some new chemicals, like PFCs, are increasing rapidly and that the main sources are in Eastern North America and Western Europe.

Future Activities:
Polar bear monitoring is an important part of the long ter Environmental Trends monitoring plan. Under this plan polar bears from five different regions, including the Amundsen Gulf, North Baffin, Fox Basin /Gulf of Boothia, west Hudson Bay and Lancaster Sound/ Jones Sound, will be sampled every five years. Samples will be analyzed for **mercury**, POPs and new contaminants.

Derek Muir - Temporal trends of Persistent Organic Pollutants and Mercury in Landlocked char in the High Arctic

What and Where:

Arctic Char were collected from lakes in the high Arctic, including Resolute Lake near the community of Resolute, and Lake Hazen on Northern Ellesmere Island. Fish from the recent collection, as well as fish from past collections in the same lakes, were analyzed for a variety of **persistent organic pollutants (POPs)**, **heavy metals** and new **contaminants** including **brominated flame retardant** and **PBDE**.

Top Three Findings:

1. **Mercury** concentrations have not declined significantly in landlocked char from Resolute Lake or Lake Hazen from the early 1990s to 2004.

2. **DDT** concentrations in landlocked char have decreased significantly in all 4 study lakes while **PCBs** have declined more slowly or not at all in char from the same lakes.

3. Total PBDEs increased significantly in concentration from 1997 to 2004 in Resolute Lake with levels doubling every 5 years.

Importance of the Results:

Arctic char from high Arctic lakes are very important indicators of contaminant levels resulting from long-range atmospheric transport. The contaminant levels found in these lakes are purely a result of contaminants being deposited from the air directly into the lakes and on the land surrounding the lakes. The **temporal trends** that were measured in this project may indicate that restrictions on POPs that are part of the **Stockholm Convention**, such as DDT and PCBs, are working. As a party to the Convention, Canada has a responsibility to assess the effectiveness of the actions taken. The indication that concentrations of PBDEs are increasing will be important for convincing international policy makers that this new contaminant should be added to the list of POPs covered by the Stockholm Convention.

Future Activities:

This project is part of the long-term Environmental Trends monitoring plan. As part of this plan, Arctic char will be collected from lakes around Resolute every year. Samples will be analyzed for mercury, POPs and new contaminants.

Alexandra Steffen - Mercury Measurements at Alert

What and Where:
We collect air and snow samples at the Alert Global Atmospheric Watch (GAW) station at Alert, Nunavut. This is part of a world-wide network of stations measuring greenhouse gases and other pollutants and we collect our **mercury** samples from the air at this station. The air samples are collected and levels are calculated with the instrument at Alert. Snow samples are collected around the Alert area and sometimes over the frozen ocean. We also participated in a study in Barrow, Alaska at the American GAW station.

Top Three Findings:
1. For the past 10 years we have measured the levels of mercury in the air and have found that they are not going up or down but are staying the same from year to year between 1995 and 2004.

2. We found that, although the level of mercury in the air does not change from year to year, it does change from season to season. We found in the winter and fall levels are what we would expect. In the spring the levels are much lower and in the summer the levels are higher than what we would expect. None of these levels of mercury in the air are dangerous when you breathe the air.

3. We have found that every year in the spring, mercury from the air attaches to particles (dust or soot in the air) and drops to the snow. This "spring thing" is something that we didn't know about before and are trying to understand why this happens and if it impacts the Arctic environment and people in a harmful way.

Importance of the Results:
These results are important to Northerners because it is important to know if the levels of mercury in the air in the Arctic are increasing or decreasing so that the government can implement policy to reduce the amount of mercury put in the air, if necessary. It is also important to know if the mercury that drops to the snow in the spring is getting into the environment and the food. Currently, we do not fully know how this "spring thing" works so more work must be done to fully understand the implications to the Arctic as a whole.

Future Activities:
The continuous measurement of mercury in air at Alert is a long-term project under the Environmental Trends monitoring plan.

Gary Stern - Temporal Trends of Halogenated Organic Contaminants in Arctic Marine Mammals (Beluga, Narwhal and Walrus)

What and Where:

This project reports levels of **persistent organic pollutants (POPs)** in blubber from beluga, narwhal and walrus that were collected near various communities between 1980 and 2004. **Temporal trends** of POPs in beluga are reported for the Mackenzie Delta, Arviat, and Sanikiluaq. Trends for POPs in narwhal are reported for Arctic Bay and Pond Inlet. Trends for POPs in walrus are reported for Hall Beach and Igloolik.

Top Three Findings:

1. Levels of POPs in Arviat beluga and Arctic Bay narwhal and walrus from Igloolik have declined significantly since the mid-1980s.

2. No trends in POP concentrations were observed in Sanikiluaq beluga or Hall Beach walrus

3. Levels of POPs in Hendrickson Island animals have risen significantly over the 15-year period from 1989 to 2004. This result coincides with a similar increase observed for **mercury** in the same animals and might be due to recent changes in ice cover and distribution in the western Arctic Ocean.

Importance of the Results:

The declining levels of POPs in the beluga from Arviat and Arctic Bay, and the narwhal and walrus from Igloolik is a very positive result. This indicates that the levels of harmful **contaminants** in these important traditional/country foods may actually be going down. This could also be an indication that international bans on the use of POPs is working to reduce contaminant levels in the Arctic. The results from the Mackenzie delta (Hendrickson Island), however, indicate that levels are rising in beluga blubber. This rise in POP levels may be a result of climate change-related changes in sea ice. Scientists are still trying to figure out how climate change will affect contaminant levels in the Arctic and these kinds of results are an important piece of the puzzle.

Future Activities:

This project is part of the long-term Environmental Trends monitoring plan. Under this plan, blubber samples from beluga narwhal and walrus will be collected by Inuit hunters from numerous communities over the next five years and analyzed for organic contaminants including POPs. Liver and blubber samples from the same animals will also being analyzed for mercury and new contaminants.

Gary Stern - Temporal Trends of Mercury in Beluga, Narwhal and Walrus from the Canadian Arctic

What and Where:

This project reports levels of **mercury** in liver from beluga, narwhal and walrus that were collected near various communities between 1980 and 2004. **Temporal trends** of mercury levels in beluga are reported for Arviat, Coral Harbour, Iqaluit, Lake Harbour, the Mackenzie Delta, Pangnirtung and Sanikiluaq. Trends for mercury in narwhal are reported for Arctic Bay, Qikiqtarjuaq, Pond Inlet and Repulse Bay. Trends for mercury in walrus are reported for Hall Beach and Igloolik.

Top Three Findings:

1. Levels of mercury in liver of walrus are lower than levels in beluga and narwhal.

2. Data on narwhal and walrus from the eastern Canadian Arctic show no clear indication of changing levels of mercury over the years when samples were collected, generally between the 1980s and 2000.

3. Levels of mercury in beluga liver have changed, but differently in different locations. In some places, like the Mackenzie Delta and Arviat, the levels have increased since the mid-1980s, but this is not the case in all communities. From one location to another, there are clearly different factors influencing mercury levels in beluga.

Importance of the Results:

Beluga, narwhal and walrus are important country food species. It is important to measure mercury levels in these species so that health authorities can better assess the potential exposure to people who eat them. It is also important to know if the levels are going up or down. If the trends are going down that may indicate that mercury exposure to people who eat the animals is also going down. It is also important to assess the temporal trend to help determine if international action to reduce global mercury emissions are actually working, or if we need to pressure the international community to cut back emissions even more.

Future Activities:

This project is part of the long term Environmental Trends monitoring plan. Under this plan, liver samples from beluga narwhal and walrus will be collected by Inuit hunters from numerous communities over the next five years and analyzed for mercury. Liver and blubber samples from the same animals will also being analyzed for **persistent organic pollutants (POPs)** and new contaminants.

Sheryl Tittlemier - Estimation of Dietary Exposure to Perfluorinated Carboxylates and Sulfonates via Consumption of Traditional Foods

What and Where:

Twenty liver samples from Arctic char, burbot, caribou, loche, ringed seal, and walrus were collected from various locations in Nunavut between 1997 and 1999. These samples were then analyzed for **perfluorinated compounds (PFCs)** in order to estimate the potential for **contaminant** exposure in the people eating these traditional/country foods.

Top Three Findings:

1. Of the samples analyzed, ringed seal liver contains the greatest amount of PFCs, followed by walrus, caribou, and fish livers.

2. The PFC concentrations observed in this study are generally similar to what has been reported for liver in other ringed seal, walrus, and fish sampled in the Canadian Arctic.

3. In the plasma pools of donors identified as Dene, Metis, or Inuit, **PFOS** and PFOA were the most abundant PFCs.

Importance of the Results:

This study only looked at the livers of some northern traditional/country food species. Seal livers showed the highest levels of PFCs. However, since seal liver is not one of the main traditional/country food items consumed, a wider variety of food items must be analyzed to obtain a better picture of the dietary exposure of traditional/country food consumers to PFCs.

An expanded survey of traditional/country food items for PFCs will also provide data to assess whether or not PFC concentrations observed in northerners are correlated to PFC concentrations in food.

Gregg Tomy - Time-Trend Studies on New and Emerging Persistent Halogenated Compounds in Marine Mammals from the Canadian Arctic

What and Where:
This project reports levels of new **persistent** organic **contaminants** in blubber and liver beluga from Pangnirtung, narwhal from Pond Inlet and walrus from Igloolik. These new contaminants include **brominated flame retardants** and **fluorinated organic compounds** that are still being used by industry.

Top Three Findings:
1. Levels of some fluorinated organic compounds such as **PFOS** increased in the liver of Pangnirtung beluga between 1980 and 2005.

2. Levels of some brominated flame retardants such as **PBDEs** and **HBCD** increased in narwhal and walrus from Pond Inlet and Igloolik respectively between 1980 and 2005.

3. Levels of short chain **chlorinated paraffins** (SCCPs) an industrial lubricant increased in the blubber of narwhal from Pond Inlet; however, levels of medium chain chlorinated paraffins (MCCPs), also an industrial lubricant, were near the detection limit, meaning they were very low.

Importance of the Results:
Even though these new contaminants are being found at increasing levels in Arctic wildlife, levels are still quite low. It is still important to measure levels of these contaminants because they are still being used in industry. By demonstrating that these contaminants are making it to the Arctic and that they are accumulating in Arctic wildlife, the **NCP** can help convince the international community to ban their use by adding them to the **Stockholm Convention**. It is important to do this while the contaminant levels are low so that the contamination can be stopped before levels in traditional/country foods become a concern.

Future Activities:
This project is part of the long-term Environmental Trends monitoring plan. Under this plan, liver and blubber samples from beluga narwhal and walrus will be collected by Inuit hunters from numerous communities over the next five years and analyzed for new contaminants. Blubber and liver samples from the same animals will also be analyzed for **persistent organic pollutants (POPs)** and **mercury**.

Nunavik/Labrador

Nunavik/Labrador

Inuit Health in Transition Study: the Nunavik Health Study

How have contaminant exposures changed over the past decade in Nunavik?

PROJECT SUMMARY:

Various studies have been conducted in Nunavik over the past decade to characterize the exposure of Inuit populations to **contaminants**. There are two main groups of contaminants that may affect human health: **heavy metals** and **persistent organic pollutants (POPs)**. The main route of exposure is through the consumption of traditional/country foods and such consumption may, in certain cases, pose a health risk. However, these foods also have many benefits such as providing protein, vitamins, minerals, and omega-3 fatty acids. Unfortunately traditional/country food consumption is declining and being replaced by store-bought foods. This has been linked with the rise of diabetes and heart disease associated with inadequate blood flow.

One objective of this project will be to continue to measure **PCBs**, organic **pesticides**, **mercury**, and other metals in blood samples taken from Nunavik Inuit adults. New contaminants, such as **PBDEs**, PFOS, hydroxy-PCBs, methyl-sulfone, and chlorophenols, are a potential concern in northern regions and will also be monitored. Another objective will be to verify **temporal trends** of contaminant exposure among the Inuit of Nunavik by comparing the 2004 Nunavik Health Survey results with data collected in 1992. The final objective will be to investigate the effects of contaminants on chronic diseases, as part of the international Inuit cohort study.

LOCATIONS OF WORK:
1. Nunavik
2. Sainte-Foy, Québec

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
Late 2005 - highlights of the survey will be presented to communities

2005-2006 - analysis will be complete

The Nunavik Health Study: Determination of Dioxin-like Compounds in Plasma Samples from Inuit Adults Using the DR-CALUX Bioassay

What are the effects of dioxin-like compounds on the Inuit population?

PROJECT SUMMARY:

It has been shown that compounds that possess a chemical structure similar to that of **dioxin** are among the most **toxic** substances and can provoke a variety effects. However there is little data on exposure of the Canadian Inuit population to these compounds and no information on possible adverse health effects. Inuit residing in the Arctic receive an unusually high exposure to **organochlorines** through the traditional/country foods that make up their diet.

This project will analyse 1000 plasma samples obtained from Inuit adults participating in the Nunavik Health Study. The analysis will provide data on the dioxin-like compound (DLC) body burden in a large sample of the adult Inuit population and it will also allow testing the hypothesis that DLCs are related to chronic diseases such as diabetes and **cancer** in the North. The DR-CALUX bioassay will be used to carry out the analysis because it has proven to be very cost effective and quick in comparison to conventional methods. These characteristics make the method particularly attractive when dealing with large samples.

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TIME FRAME:
2005-2006 scientific article prepared

LOCATIONS OF WORK:
1. Nunavik
2. Sainte-Foy, Québec

SCHEDULE:
For more information on the project, please contact the project leader directly

Nunavik Cohort Study on Exposure to Environmental Contaminants and Child Development: Follow-up at 9 Years of Age

What are the effects of contaminants in northern populations and can nutrients found in traditional/country food protect against any adverse effects?

PROJECT SUMMARY:

Research has shown that prenatal exposure to **PCBs** and **mercury** is associated with subtle growth and developmental effects in children. These **contaminants** are carried from industrialized countries to the Arctic by long-range atmospheric transport, waterways, and oceanic currents. Due to their high **lipophilicity** and resistance to biodegradation, Inuit communities are exposed to these pollutants through their diet. A serious problem can arise because pollutants will continue to **bioaccumulate** in the animal's tissue thoughout its life. If an animal is preyed upon then **biomagnification** may occur, and the further up the **food chain** the more important this process becomes. However, it is important to keep in mind that the consumption of fish and marine mammals is very healthy partly because it provides people with many nutrients, which are known to enhance early brain development.

This project will follow up three Nunavik studies from the last decade: monitoring of prenatal exposure from cord blood sampling; an effects study with infants up to 12 months of age; and an effects study with preschool children. Pre- and postnatal exposure to environmental contaminants will be documented for 307 children with an average age of nine. Nutrients found in traditional/country foods will be evaluated in order to determine their ability to protect against contaminants. It will also be very important to determine what other factors are involved in an individual's health, such as lifestyle factors (e.g. smoking, alcohol, and drug use). All of the work will be conducted in Puvirnituk, Inukjuaq, and Kuujjuaq; anyone outside of these communities will be brought in.

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LOCATIONS OF WORK:
1. Kuujjuaq, Nunavik
2. Puvirnituk, Nunavik
3. Inukjuaq, Nunavik

SCHEDULE:
For more information on the project, please contact the project leader directly

TIME FRAME:

April 1, 2005 - purchase assessment materials

April-May, 2005 - hire and train staff

June, 2005 - translate test directions and verbal items

July, 2005 - field test child and maternal assessments

Aug-Sept, 2005 - analyse data collection

Oct-Nov, 2005 - collect data in Kuujjuaq

Dec 2005-Jan 2006 - code and enter data

Feb-March, 2006 - collect data in Puvirnituk

Nunavik Nutrition and Health Committee Communication and Coordination Program

How can information from NCP contaminant research be best communicated to the communities in Nunavik?

PROJECT SUMMARY:

In 1988 the **PCB** Resource Committee was established and has since changed its name to the Nunavik Nutrition and Health Committee (NNHC). The name was changed to reflect the group's changing perspectives as they took on a more holistic approach to environmental and health issues, including both benefits and risks. It is the authorized review and advisory body for health and nutrition issues in the region and provides guidance and liaison services for researchers and agencies. The public also receives communication and education material from the committee on health and environmental topics and research projects. Overall, the committee represents Nunavik's interests at the national and international level.

The NNHC will work to finalize the follow-up of communication activities related to handing out the results of the infant development studies. The committee will play a very important role in assisting the coordination and education of the communities on the health research proposed for the region this year. The Inuit communications survey results must also be handed out and a regional communication strategy plan must be developed for the next five years. The NNHC also wants to develop a regional food policy that will take into account Nunavimmiut concerns about **contaminants**.

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LOCATIONS OF WORK:
Nunavik

SCHEDULE:
For more information on the project, please contact the project leader directly

TIME FRAME:
April 2005 - March 2006

Communicating on Contaminants and Health in Labrador

How can communication material be created to best suit individual community needs in Labrador?

PROJECT SUMMARY:

The **Northern Contaminants Program (NCP)** has been operating for many years, which allows a degree of continuity in the research and communication efforts being performed. The Labrador Inuit Association's (LIA) Research Department is responsible for coordinating and conducting research and communicating information on **contaminants** and other environmental issues. Previous NCP-funded projects have aided the LIA in improving the way information is prepared and delivered to Inuit communities. The Research Department also identifies and responds to community concerns regarding these issues. In 2003-2004 communication surveys took place in Labrador and concluded that there was low recognition of long-range contaminant issues, a lack of understanding of basic contaminant concepts, and variations between regions with regards to comprehension and awareness. In 2004-2005 LIA began a long-term strategy and planning process for their communications research and activities related to contaminants, nutrition and health. More emphasis is now being placed on a long-term plan to build capacity and understanding among Labradorimiut through communication and education efforts done in a culturally appropriate and effective manner.

This project will continue to coordinate research and communications, develop regional and target-audience-specific material and engage the population on these issues. The quarterly LIA Research Office Newsletter will continue to be produced, enhancing decision-making capacity among Labrador Inuit on issues pertaining to wild foods and their benefits and risks. Inuit Tapiriit Kanatami (ITK) communications material, which includes basic standard fact sheets on contaminants, health and nutrition issues, will be translated and regionally specific information will be added to key fact sheets. Case study review projects will also be carried out in order to better understand the 2003-2004 survey results and identify some of the key factors influencing communication outcomes related to contaminants and health communication events.

LOCATIONS OF WORK:
Labrador

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
Nov 30 , 2005 - complete regional communication strategy document
March 31, 2006 - complete communication materials
- complete collecting Labrador-specific images/digital library

Other Locations

Other Locations

Developmental Neurotoxicity of a Persistent Organic Pollutant (POP) Mixture Mimicking the Exposure of Canadian Northern Populations

What are the effects of contaminants on brain functioning?

PROJECT SUMMARY:
Persistent organic pollutants (POPs) have been shown to lead to **neurobehavioural** effects and changes in brain **gene expression** (i.e. changes to a brain gene on its active state). Better knowledge of the mechanisms (at the molecular level) that underlie the effects of neurotoxicants is essential to improve risk assessments of vulnerable human populations (e.g. infants and children) exposed to these chemicals. Current studies are looking at what happens to laboratory animals during periods of rapid brain development. It is thought that studying this sensitive period of brain development will aid in determining the molecular targets of **neurotoxins** (**methylmercury**, **PCB congeners**, or **organochlorine pesticides** - three major chemical families of environmental pollutants found in Arctic traditional/country foods) and predict neurobehavioural effects.

This project will investigate the biological mechanisms underlying the effects of environmental neurotoxicants, in laboratory studies. The main focus of the project will be to observe the neurological effects in rats of a **persistent** environmental **contaminant** mixture that mimics human exposure in the Canadian Arctic region. During these tests certain genes will be noted to have different expression levels from the norm, when the rats are exposed to contaminants. These genes are known as informative genes, which can then be used to produce protein and gene expression patterns. These patterns will be used to link specific neurotoxins to effects on brain functioning. This research will help identify and develop new **biomarkers** that can be used as tools to screen for the neurotoxicological effects of existing contaminants, mixtures or emerging pollutants.

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TIME FRAME:
Early 2006 - completion of data analysis

LOCATIONS OF WORK:
Ottawa, Ontario

SCHEDULE:
For more information on the project, please contact the project leader directly

Neurotoxicological, Thyroid and Systemic Effects of *In Utero* and Lactational Exposure to Polybrominated Diphenyl Ethers (PBDEs) in Sprague-Dawley Rats

? *What are the effects of PBDEs on the central nervous system?*

PROJECT SUMMARY:

Polybrominated diphenyl ethers (PBDEs) are a group of chemicals that are used as flame retardants in thermoplastics, polymers and textiles. Research in the last 20 years has demonstrated that PBDE exposure has been increasing in North American populations. When samples from the Canadian Arctic were analysed, PBDEs were found in the environment and wildlife at low but increasing levels. Because Arctic human populations rely on wildlife as a substantial part of their diet it is possible that exposure levels in the population are also increasing. It is believed that exposure to PBDEs will cause changes to **neurobehavioural** function, thyroid function and/or **cancer**, and that fetuses and infants are the most sensitive populations.

This project will evaluate the effects of exposure to PBDEs on neurotoxicological and thyroid functions. The systemic toxicity after PBDE exposure will be studied in rats, as well as the effects of PBDEs over the rats' life in order to determine the persistence of health effects and the potential for adverse health effects later in life. Neurobehavioural testing will assess general neurobehavioural functioning, including memory and learning. The knowledge gained from these studies will assist regulatory bodies in developing guidelines and tolerable daily intakes for humans.

LOCATIONS OF WORK:
Ottawa, Ontario

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
2005-2006 - tissue collection and analysis will take place

Characterising Risks Associated with Fetal Exposure to Methylmercury

What are the effects of methylmercury on the developing fetal brain?

PROJECT SUMMARY:

The brain of the developing fetus undergoes a series of developmental stages during growth, some of which are more sensitive than others to **contaminants** or pharmaceutical drugs taken by the mother. Published research results identify the end of the first three months of human pregnancy as the most vulnerable period of brain development for the fetus. Previous studies have also shown that pregnant women who regularly consume a lot of marine fish with low levels of **mercury** usually have children with no signs of health problems. In contrast, pregnant women who consume less fish but overall ingest more contaminants sometimes have children who show subtle symptoms that may be linked to contaminants. The **Canadian Arctic Contaminants Assessment Report II (CACAR II)** highlighted continuing health concerns about **methylmercury** (MeHg) exposure in northern communities and identified some knowledge gaps. These gaps must be answered to gain a full understanding the effects of MeHg on the exposed population.

This project will use mice to study how mercury causes underlying **toxic** effects when it is consumed over a short period of time at high concentrations. The contaminants, stable mercury **isotopes**, will be introduced during the most susceptible periods of prenatal brain injury. The results obtained from these studies will increase the evidence that will potentially allow scientists to predict the type of effects that could occur to the brain if pregnant women consume a diet with elevated mercury levels at certain critical times during pregnancy. Past research has discovered that one of the main exposure routes of MeHg is through fish; however the benefits of eating fish appear to still outweigh the risks. The project will also assist in updating human health guidelines for MeHg for populations in the North and help safeguard development during the most sensitive stage of life.

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LOCATIONS OF WORK:
Ottawa, Ontario

SCHEDULE:
For more information on the project, please contact the project leader directly

TIME FRAME:
September 2005 - present up-to-date results

Decision Support Tool for Risk and Benefit Balancing of Country Food Issues in the Canadian Arctic (Year 2)

Can health care workers be helped in making decisions about traditional/country food by using a decision support tool?

PROJECT SUMMARY:

In the North, traditional/country food is seen as the anchor for cultural and personal well being. It is an essential part of the nutritional and social health of northern Aboriginal people. Due to the fact that the majority of traditional/country food is composed of local wildlife, it is not surprising that it provides the greatest source of protein to the northern diet as well as vitamins and essential elements. Research has determined that omega-3 fatty acids, found in fish oils, provide protection against arteriosclerosis, heart disease, and some **cancers**; while **selenium**, from marine species, is an antioxidant and a known anticarcinogen. However there are some risks associated with eating traditional/country foods and current research suggests there is an association between exposure to some **contaminants** and **neurodevelopmental** effects in Inuit infants.

This project will address the need to develop methods that support decision making and communication by northern health professionals and individuals in order to balance the benefits and risks associated with the consumption of traditional/country foods. The problem lies in that as the knowledge of the benefits and risks increase, the development of clear and easy-to-understand messages becomes more complex. The goal will be to develop an easy-to-use decision support tool, which incorporates the most relevant benefit-risk balancing methodologies to aid northern health professionals and other decision makers in considering these issues and providing advice to northern populations.

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LOCATIONS OF WORK:
1. Ottawa, Ontario
2. Sainte-Foy, Québec

SCHEDULE:
For more information on the project, please contact the project leader directly

TIME FRAME:

June 30, 2005 - expert consultation and review of methodologies and data

August 30, 2005 - update report describing decision-support model

December 31, 2005 - report of consultation with Northern Health Professionals and Experts on the application model

December 31, 2005 - Complete the analytical model for the decision-support tool

Inuit Participation at Stockholm Convention COP 1 and Russian PTS Workshop

What is the best way to aid Canada in meeting all its obligations under the Stockholm Convention?

PROJECT SUMMARY:
In 1988, very few people understood the significance of transboundary pollution and its relation to **persistent organic pollutants (POPs)**. Over the last several years the **Northern Contaminants Program (NCP)** has provided a lot of the scientific justification that has been used at international negotiation tables to address the issue of **long-range transport** of **contaminants**. Three international agreements have since been created; the **Stockholm Convention** and two protocols under the United Nations Economic Commission for Europe's (UNECE) Convention on Long-range Transboundary Air Pollution. On May 17, 2004 the Stockholm Convention on POPs entered into force and all the member countries are now required to meet their obligations.

This project will participate and assist the Canadian federal delegation in preparing for the first Conference of Parties (COP 1). During COP 1, Inuit Circumpolar Conference (ICC) Canada will organize an information session/workshop on the value added and capacity development of Indigenous peoples using the Russian Persistent Toxic Substances (PTS) Report as a case study. An attempt will also be made to establish connections with other Indigenous and civil society agencies/organizations that can share information and experiences on contaminant capacity development. The ICC Canada long-term goal is to ensure that Inuit are aware of the global, circumpolar and national activities and initiatives regarding contaminants and are in a position where they can effectively participate in these initiatives.

LOCATIONS OF WORK:
International

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
April 2005 - March 2006

Coordination and Administration of the Northern Contaminants Program (NCP)

How is the Northern Contaminants Program administered?

PROJECT SUMMARY:
Since 1991, Indian and Northern Affairs Canada (INAC) has provided the **Northern Contaminants Program (NCP)** with financial administration and management services to support many scientific and northern-related projects. These administration and management services enable the central co-ordination of the program among four federal departments, four Aboriginal organizations, departments from three territorial governments, Nunavik/Labrador and approximately 12 universities and research institutes. INAC also provides secretariat support for the project review teams and the oversight Management Committee. This management structure ensures that the program remains scientifically defensible while, at the same time, achieving real progress in terms of its broad policy objectives.

INAC headquarters will continue to offer financial and secretariat support to, and overall co-ordination of, the NCP. This will include at least two Management Committee meetings and various ad hoc meetings and workshops. INAC will also co-ordinate and implement various communications activities with the Aboriginal partners and the territorial **contaminants** committees. Some highlights of activities this year include: updating Blueprints for the Human Health; Environmental Trends; and Education and Communications subprograms of the NCP; producing the annual Synopsis Report of research results and holding the Results Workshop; facilitating production of **Canadian Arctic Contaminants Assessment Report II (CACAR II)** results in scientific journals; maintaining and updating the NCP website; further development of the database of current and past NCP; and enhancing the on-line proposal submission and management system.

LOCATIONS OF WORK:
Gatineau, Québec

SCHEDULE:
For more information on the project, please contact the project leader directly

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TIME FRAME:
April 2005 - March 2006

Contributing to International Controls on Pops and Mercury: The Application of Global Mass Balance Models

Can the BETR-World-model accurately predict spatial and temporal trends of Hg and POPs?

PROJECT SUMMARY:

Results from research done on **contaminants** in the Arctic **ecosystem** have demonstrated **long-range transport** of chemical substances from the temperate industrial and agricultural regions of the Northern hemisphere. An inevitable consequence of this is the exposure of the resident populations to these substances through their food, air and water supplies. It has been recognized that the only way to reduce the levels of these contaminants is to reduce the emissions from all global sources. Agreements, such as the **Stockholm Convention**, have been created to accomplish this task. This agreement however should be amended to include new emerging **persistent organic pollutants (POPs)**. In order for a country to propose adding a new POPs to the Convention, the substance must first be proven to be **persistent**, **toxic**, **bioaccumulative** and subject to long-range transport. The development of global contaminant models will help to predict which new chemicals are capable of being deposited in the Arctic. These models can also predict where contaminants come from, how they move around the world and end up in the Arctic and how long they will take to disappear once they are banned.

This project will continue the research program at the Canadian Environmental Modelling Centre on modelling the sources and fate of POPs and **mercury**. This year the parameterization and testing of the Berkeley-Trent (BETR)-World-mercury model will be completed. The model will be tested against published data on sources and ambient levels of mercury, especially in the atmosphere. Once the verification of the BETR-World-mercury model is finalized then historical cycling of mercury will be simulated and the Transfer Efficiency and dominant regional contributors will be determined. The project will also be involved in compiling a detailed, spatially and temporally explicit global **anthropogenic** mercury emissions database. All the results are expected to be published in scientific and popular literature to increase the exposure to the international community.

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TIME FRAME:
April 2005-March 2006

LOCATIONS OF WORK:
Peterborough, Ontario

SCHEDULE:
For more information on the project, please contact the project leader directly

Wayne Bowers - Neurotoxicological, Thyroid and Systemic Effects of *In Utero* and Lactational Exposure to Polybrominated Diphenyl Ethers (PBDEs) in Sprague-Dawley Rats

What and Where:

This is a laboratory study in rodents examining the neurotoxicity of **PBDEs** in offspring exposed during gestation and lactation. This study examined effects of PBDEs in young, mature and old animals on capacities like activity, reactivity, learning, and memory. This study also examined effects on thyroid hormones, molecular markers in brain, brain chemistry relevant to learning and memory, neuropathology and systemic toxicity. Analysis of tissue levels in rat mothers and offspring is being conducted to facilitate translation of exposure doses in this study to human exposures. This is a two-year study with an expected completion date of March 2006.

Top Three Findings:

1. Perinatal PBDE exposure produces small decreases in growth in mothers and offspring

2. PBDEs produces systemic toxicity, alters thyroid hormone levels and rat offspring are 10 times more sensitive than mothers

3. PBDEs alter measures of activity and reactivity in young animals but the persistence of these effects is not yet clear. Relevance of the effective exposure doses to Arctic populations will be determined by examining tissue levels in mothers and offspring.

Importance of the Results:

PBDE levels have been increasing in North America in the environment and in wildlife and, like **PCBs**, PBDEs are **persistent** and **bioaccumulative**. PBDEs have been found in the Arctic environment and wildlife. Because native Arctic populations rely on wildlife as part of their diet, it is likely that they are also exposed and there is concern that levels of PBDEs may be increasing faster in the Arctic than elsewhere. Though PBDEs are known to affect thyroid function, there is relatively little toxicology information on these chemicals and nervous system and endocrine **toxicity** are thought to be the likely targets of PBDEs, especially for fetuses and infants. Though exposure to PBDEs in Arctic populations through traditional/country foods has not been well established, it is generally believed that this is the most likely exposure scenario for Arctic populations. As such, toxicology results from this study may have ramifications on traditional/country foods consumed since this will largely determine PBDEs exposure levels.

Future Activities:

This is year one of a two-year project. Future results will include measures of learning and memory, brain biomarkers of neurotoxicity, and measures of tissue levels of PBDEs. All work will be conducted at Health Canada's Ottawa research facilities

Ih Chu - Developmental Neurotoxicity in Rats of a Persistent Organic Pollutant (POP) Mixture Mimicking the Exposure of Canadian Northern Populations

What and Where:
Using rats as an animal model, this study was carried out to determine the developmental effects of mixtures of **persistent organic pollutants (POPs)** similar to those found in the North. After rats were given mixtures of chemical pollutants for a defined period, the offspring were monitored for growth, mortality and thyroid hormone status.

Top Three Findings:
1. The effects of the **contaminant** mixture on growth and mortality are attributable to the **methylmercury** component.

2. The effects of the contaminant mixture on the thyroid hormone status are attributable to **PCBs**.

3. The effects on mortality and growth in rat pups were reduced when the pollutants were tested as a mixture, i.e. co-presence of some components may partially offset effects of others.

Importance of the Results:
When completed, this project will provide a better understanding to whether the pollutants in Northerner's traditional/country food will be harmful to their health. Most importantly, sensitive laboratory tests developed in this project may serve as a useful tool to diagnose such effects before clinical symptoms occur. This project also points out the importance of studying nutrient-contaminant interactions and predicts unforeseen consequences due to the variation of specific pollutants over time.

Future Activities:
Completion of the analysis of effects of **PBDEs** on the rats still has to be undertaken.

Daniel Desaulniers - Long-Term Effects Following Postnatal Exposure to Breast Milk Contaminants: Is it Real?

What and Where:

Performed laboratory research analyzing rat tissues, to assess health risks associated with pre- and postnatal exposure to environmental **contaminants**.

Top Three Findings:

1. Preliminary analysis revealed that in the rat, exposure of the fetus to high doses of contaminants during pregnancy, combined with exposure received by the pups through the mothers milk, dramatically changed the normal liver transformation of the hormone estrogen into **toxic** byproducts, and others that are beneficial to health. The cumulative impact on health is still unknown.

2. Three groups of contaminants [**organochlorine (OC) pesticides**, **methylmercury (MeHg)**, polychlorinated biphenyls (**PCBs**)] were found to increase the amount of cellular messages dictating the production of proteins required for the elimination of these chemicals. When tested altogether in a single mixture, the amount of cellular messages was much larger than when the amounts produced by the individual groups are added up together. In contrast, this "synergistic" effect was not observed when other endpoints, not involved in the elimination of the chemicals, were measured. Synergistic endpoints are sensitive indicators of exposure, but others are required to demonstrate toxicity.

3. Our genetic code is included in the DNA located in the chromosomes of our cells. The genetic code is constantly used by cells for normal functions and differentiation into various tissue types during development. A group of proteins called DNA methyltransferases (DNMTs), are involved in controlling access to the genetic code and in conferring the normal structure of our chromosomes. Exposure to PCBs, and MeHg (but not OCs), reduces the amount of cellular messages required for the production of these DNMTs, suggesting that cells may be at risk of not functioning and developing normally.

Importance of the Results:

At this early stage of the project, all effects occurred at much higher levels of exposure than what could be considered relevant to the Northern communities. Compared to Southern populations, Northern communities may be at higher risk of adverse health effects because they have higher amounts of some contaminants in their body. Intensive research programs are being conducted to better understand the possible adverse health effects of exposure to environmental contaminants, and to take corrective measures if required.

Future Activities:

There is still more work to do to look at the effects of these contaminant mixtures at different dose levels, and also to look at whether the effects seen in rats is due mainly to contaminant exposure while the rats are in the womb, or after birth.

Mike Inskip - Characterizing Risks Associated with Fetal Exposure to Methylmercury in an Animal Model to Aid Guideline Development for Exposure in Human Pregnancy

What and Where:

Our research involves working with laboratory mice to see how **methylmercury** is distributed in the organs - like the brain - of the mothers and their pups. We looked at how the organic form of **mercury** (the type present in fish) was absorbed in laboratory mice, to see if it got to the brain and also, how much was transferred to the brains of their unborn fetuses. We also looked to see what happened differently when some of the mice were given a larger amount (a 'spike' or a 'bolus') of mercury on two occasions during pregnancy. Did this - for example - mean the fetus also received a 'spike' of mercury that might affect the normal development of the brain?

Top Three Findings:

1. We can learn a lot about how substances like methylmercury behave in humans (during pregnancy) by looking at what happens in laboratory mice - by giving the chemical in small amounts - similar to the quantities eaten by some people - and tracking to see where it goes.

2. We can use the natural properties of mercury (its being made up of a number of naturally occurring **isotopes**) to create in our laboratory, a special 'mixture' of isotopes, and one that has a unique "fingerprint". This is a useful tool for us to investigate how it gets into the brains of animals and humans. We use a gas chromatograph linked to a mass spectrometer to distinguish between this special mixture when we find it in the tissues, and the naturally occurring mixture of mercury isotopes that is also present.

3. Early results from our work do suggest that a large (spike) dose of methylmercury received during pregnancy by a mouse does get transferred to the fetus (and is deposited in the brain tissue).

Importance of the Results:

By looking at how methylmercury accumulates in the brain of the mouse fetus, we can gain valuable information as to what might also be happening in human pregnancy.

Future Activities:

We have carried out a pilot phase to test and improve the scientific methods we plan to use, as they are quite complicated. Now, this year we plan to run the main part of the study and see if the mice we give the mercury to produce pups which show subtle effects on their behaviour, as a result of the way we will be dosing them (with 'spike' or 'bolus' doses of methylmercury).

Yi-Fan Li - Digital Arctic for Environmental Study (DAFES): A Continuous Project

What and Where:
In cooperation with the Arctic Monitoring and Assessment Programme (AMAP), this project has involved the development of a database designed to store information of all kinds relating to the Arctic, including **contaminants** data. An internet-based geographic information system (GIS) has also been developed that allows users to display various combinations of information on a circumpolar map.

Top Three Findings:
1. All available pollutant data from AMAP assessment reports (AMAP 1998 and 2002), including some data from other publications, have been collected, and stored in the DAFES system. The sources of each piece of data have been clearly cited. The data in the system can be easily searched, queried and downloaded, and displayed using a GIS tool.

2. Contaminant concentrations generated between 1980 and 2002 are available for over 100 types of **persistent organic pollutanat (POP)** compounds, 8 **heavy metals**, and 25 radionuclides.

3. There are more than 27,000 records for POPs, almost 19,000 for heavy metals, and more than 2,000 records for **radionuclides**.

Importance of the Results:
The DAFES brings together information of all kinds related to the Arctic environment, including contaminants data from the **Northern Contaminants Program (NCP)**, in one database that will be accessible by anyone over the internet. The DAFES also allows users to display contaminants information along with a variety of other information, e.g. climate information, thereby allowing researchers to explore different combinations of data from multiple scientific disciplines. This project is important because it provides another way in which NCP-related information is communicated to a wide range of potential audiences. Some potential users of DAFES include international researchers and policy makers, community-based researchers and educators.

Future Activities:
One of the remaining steps for this project is the development and implementation of the internet-based tool for public use. This project was not funded by the NCP in 2005-2006.

Don Mackay - Contributing to International Controls on POPs and Mercury

What and Where:

A computer model that was developed to simulate, and make predictions about, the global transportation of **persistent organic pollutants (POPs)** and their deposition in the Arctic is being used to study **mercury** and how it is transported from global sources to the Arctic. This model was developed by researchers from Berkeley and Trent Universities and is called the Berkeley-Trent (or BETR) world model.

Top Three Findings:

1. Existing models that apply to organic contaminants can now be applied to substances such as mercury provided that certain key assumptions apply.

2. The factors which cause a chemical to be subject to long-range atmospheric transport to the North have been more clearly identified.

3. Efforts continue to discuss the issue of transport to the North in the scientific media with a view to influencing foreign governments to support local controls on contaminant releases.

Importance of the Results:

Models such as the one being used in this project help scientists understand how contaminants are transported from source regions, usually in industrialized regions of the globe, to the Arctic where there are very few sources. The models also help scientists present these transport mechanisms to policy makers and convince them to cut emissions of contaminants in regions that may be far from the Arctic. The models will also be useful for assessing new chemicals for their potential to contaminate the Arctic. If a new chemical is shown to have a high potential for **long-range transport** and deposition in the Arctic, we may be able to convince governments to regulate the chemical before levels in the Arctic become a concern.

Future Activities:

This project is a part of the NCP's long-term Environmental Trends program. Future activities include applying the model to some of the new contaminants, such as the **brominated flame retardants**, to help investigate their sources and pathways to the Arctic.

Marc-Edouard Mirault - Interactions between Northern Contaminants and Omega-3 Fatty Acids and Selenium in Central Nervous System Development

What and Where:

The traditional Inuit diet is rich in omega-3 polyunsaturated fatty acids and **selenium** (Se) but can also contain environmental pollutants such as **methylmercury (MeHg)** and **organochlorines (OCs)**. Little is known on the interaction between these toxicants and dietary factors. This project was based in a laboratory, and studied mice in order to look at the interaction stated above.

Top Three Findings:

1. Selenium had significant protective effects against MeHg-mediated fetal **toxicity**. These results suggest a strong benefit of high selenium and omega-3 fatty acid content in the traditional Inuit diet.

2. Elevated intake of omega-3 fatty acids with low selenium was found to have detrimental effects on mouse perinatal development.

3. Optimal amounts of dietary antioxidants (including selenium and vitamin E) should be included in omega-3-rich diets in order to avoid any developmental toxicity potentially associated with excess omega-3 fatty acids.

Importance of the Results:

This project highlights the importance of the Inuit diet (high in both selenium and omega-3 fatty acids) in reducing the toxicity of methylmercury during fetal development. However, the traditional Inuit diet not only contains methylmercury but also by complex mixtures of organochlorine contaminants including **PCBs**. It will thus be very important to also assess in the laboratory what might be the beneficial or detrimental effects of selenium- and omega-3 fatty acid-enriched diets on the perinatal toxicity of mixtures of organochlorine **contaminants**.

OTHER

Timothy Schrader - *In Vitro* Examination of Food-borne Polychlorinated Pesticide Residues for Effects on Cytochrome P450 Isozyme Induction/Activity

What and Where:

The project consisted of lab work using commercially available kits used to measure the effect of polychlorinated **pesticides** on:
a) inhibition of purified human **enzymes** involved in the breakdown of drugs
b) induction of similar enzymes in rat liver cells, which are known to maintain at least some of this capability.

Top Three Findings:

1. The polychlorinated pesticides **toxaphene**, **chlordane**, and related compounds which persist in wildlife and humans can inhibit the activity of several purified enzymes involved in the deactivation and breakdown of drugs and poisons. However, the levels of chemicals needed to exert these effects are several-fold higher than those detected in blood and milk samples. Therefore there is little concern that polychlorinated pesticide contaminants have an effect on drug metabolism in the adult population.

2. The polychlorinated pesticides were also found able to induce various drug breakdown enzymes in a rat liver cell line. However, again, in most cases, the concentrations needed to do this were far higher than would be encountered by Northern residents, and is therefore likely of little concern.

3. The polychlorinated pesticides were found to inhibit an activity corresponding to a human fetal enzyme form at levels of contaminants approximately 10-fold higher than have been detected in human milk. Since the amounts of chemicals are still higher than would be encountered, but with less of a safety factor, it is difficult to assess whether this really poses any significant health risks to newborns. This aspect is being examined more closely in additional experiments.

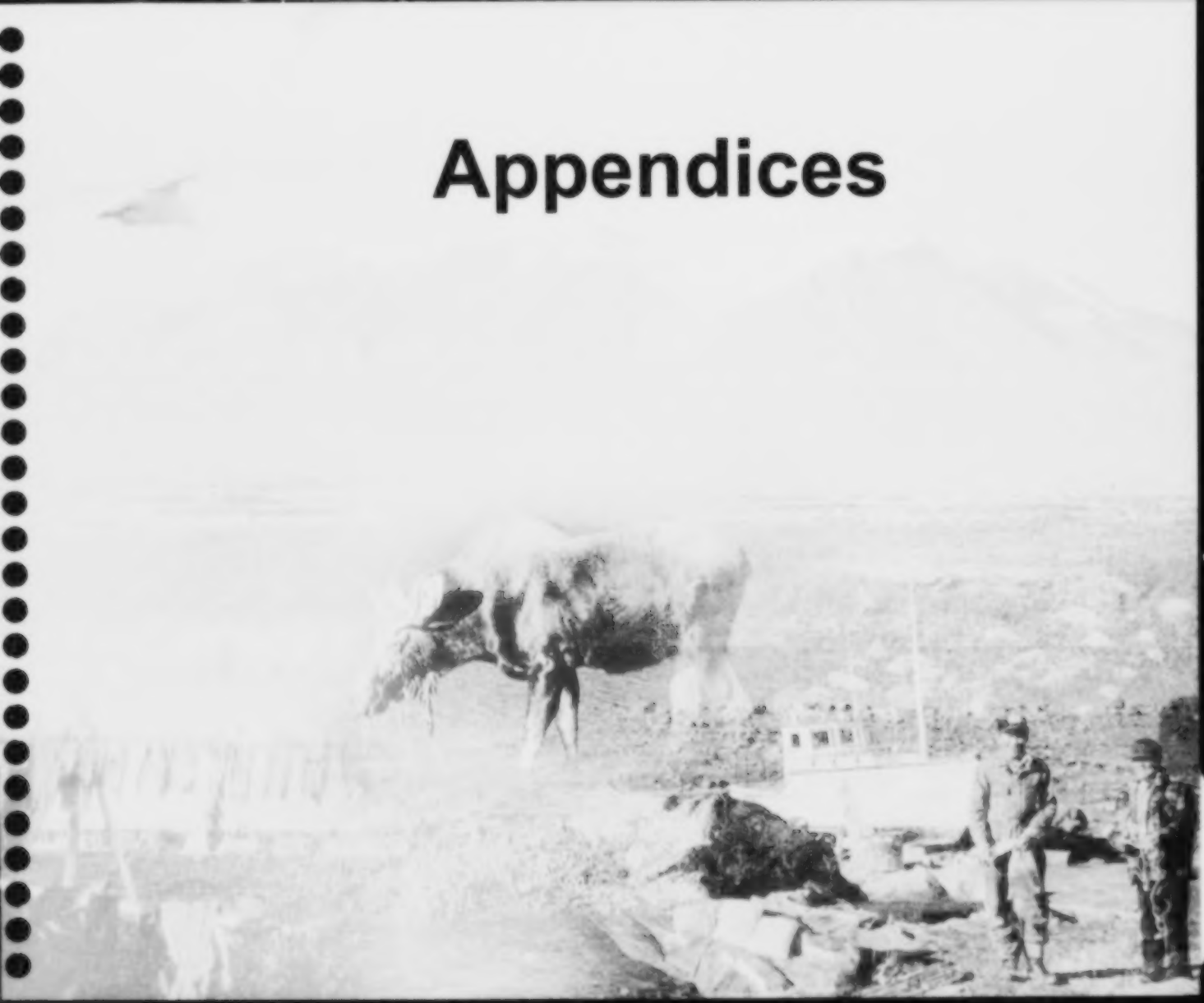
Importance of the Results:

Traditional/country food was not observed to interfere with the process a drug undergoes to breakdown. However, it is still suggested that women limit the consumption of foods containing contaminants during pregnancy and nursing. At the present time this appears to be a remote concern but more data will be needed to characterize it further.

Future Activities:

The project will be completed by the fall by:
1) examining polychorinated pesticide effects on 2 or 3 other enzymes involved in drug breakdown enzymes, and 2) further characterizing the effects of polychlorinated pesticides on enzyme production

Appendices



Appendices

Glossary

ABIOTIC
An abiotic environment refers to the non-living natural environment made up of non-living, **inorganic**, objects such as rocks and minerals.

AMAP
The Arctic Monitoring and Assessment Programme (AMAP) is an international organization established in 1991 to implement components of the Arctic Environmental Protection Strategy (AEPS). Now a programme group of the Arctic Council, AMAP's current objective is "providing reliable and sufficient information on the status of, and threats to, the Arctic environment, and providing scientific advice on actions to be taken in order to support Arctic governments in their efforts to take remedial and preventative actions relating to contaminants".

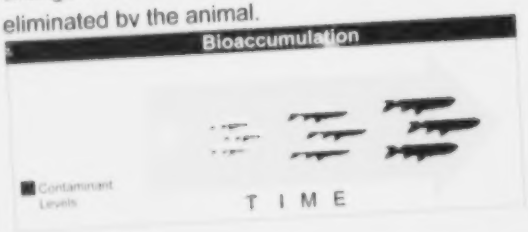
ANTHROPOGENIC
Originating from human activity.

ARCHIVED
Archived samples are samples (e.g. animal tissues or organs) that are stored, usually in freezers, for future analysis.

ARSENIC
Arsenic is a steel grey, brittle metallic element that is found naturally in rocks and soil. Some of its compounds are poisonous and are used as agricultural **insecticides** and poisons. Arsenic can **bioaccumulate** in plants and animals.

BENTHIC
The benthic layer is the sediment and mud found at the bottom of lakes, rivers and oceans. Benthic organisms live on the bottom or in these sediments. Pelagic organisms live in the water column.

BIOACCUMULATE (BIOACCUMULATION)
Bioaccumulation is the build-up or storage of substances (such as **contaminants**) in the bodies of animals over time. Bioaccumulation of contaminants can occur by one organism eating another or drinking water that contain these contaminants. Contaminants that bioaccumulate are very slow to change or do not change to a chemical form that can be digested and eliminated by the animal.

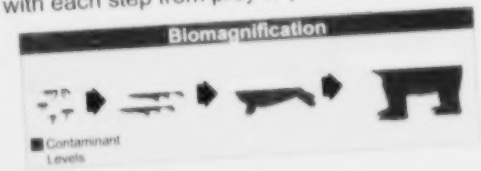


BIOASSAY
The appraisal of the biological activity of a substance by testing its effect on an organism.

BIOAVAILABILITY
A chemical is bioavailable when it is in a form that can be taken up or absorbed by plants and animals.

BIOMAGNIFY (BIOMAGNIFICATION)
When an animal eats a plant or another animal, it consumes all the contaminants stored in that food.

Contaminants can biomagnify in animals that use other animals for food because the concentration increases with each step from prey to predator.



BIOMARKER
A biomarker is a certain biological element that undergoes change when exposed to a stressor, such as chemical contamination. Biological chemicals such as **enzymes** are common biomarkers used to detect exposure to contamination as well as subtle (non-serious) biological effects caused by **contaminants**.

BIOMONITORING
Biomonitoring is a method of testing and monitoring different **contaminants** in the environment through living organisms. For example, polar bear tissue may be analysed as a way of biomonitoring **POPs** in the Arctic marine environment.

BIOTA
The animal and plant life (i.e. living things) of a region.

BIOTIC
A biotic environment refers to living organisms in the environment.

BROMINATED FLAME RETARDANTS (BFR)
Brominated flame retardants are a group of organic compounds that are commonly used in synthetic materials to decrease flammability. BFRs are found in many plastics and foams that are used in products like car parts, computers and household furniture. Three subgroups of BFRs are:

- Aromatic, including tetrabromobisphenol A (TBBPA), **polybrominated diphenyl ethers (PBDEs)** and **polybrominated biphenyls (PBBs)**
- Aliphatic, which are generally used in relatively small quantities
- Cycloaliphatic, including **hexabromocyclododecane (HBCD)**

BROMINE (BROMINATED)
Bromine is a naturally occurring element. It is a dense, deep reddish brown liquid that is easily vaporized into a brownish-red **vapour**. It occurs mainly as the bromide ion, Br^-, in salts in seawater and in many saline springs. Metal bromides occur in small amounts in seawater and salt deposits as well as in water from mineral

springs. One of the most common uses of bromine is for the manufacture of bromine compounds used in gasoline. Bromine compounds are also widely used in **pesticides** and for treating plastic material and textiles to make them fireproof.

CADMIUM

Cadmium is a **heavy metal** found naturally in soils and rocks. It is soft and has a silvery colour. It is mined and used in some industries to make things such as batteries, some **pesticides**, and some types of paint.

CANADIAN ARCTIC CONTAMINANTS ASSESSMENT REPORT II (CACAR II)

This report, also referred to as CACAR II, is a comprehensive assessment of **contaminants** in the Arctic. CACAR II contains detailed results of all the research that was conducted during the second phase of the **Northern Contaminants Program** (1998-2003).

CANCER

Cancer is a disease that results in uncontrolled, abnormal growth of the body's cells resulting in tumours (large masses of cells).

CHLORDANE

Chlordane is a colourless, odourless **POP** used as an insecticide. It can affect the nervous system of humans and wildlife. Chronic exposure to humans can cause liver damage and possibly cancer. It is currently restricted in use for such things as termite control and non-food plants.

CHLORINATED PARAFFINS (CPs)

Chlorinated paraffins (CPs) are chlorinated derivatives of n-alkanes, having carbon chain lengths ranging from 10 to 38, and a chlorine content ranging from about 30 to 70% (by weight). The melting point of CPs increases with increasing carbon chain length and with increasing chlorine content. It has also been found that **toxicity** or environmental effects can vary depending on the chain length.

CHLORINE (CHLORINATED)

Chlorine is a naturally occurring, poisonous greenish-yellow gaseous non-metallic element used for purifying water, bleaching and in the manufacturing of many **organic** chemicals. It occurs naturally only as a salt, as in sea water.

CONGENER

The individually distinct chemicals that belong to a family of chemicals with similar basic structure, such as **PCBs** and **dioxins**, are know as congeners. PCBs are a mixture of different PCB congeners.

CONTAMINANTS

A contaminant is a substance that is found in a place where it should not be. This does not necessarily mean that it is harmful, but depending on what it is and the amount that is present, it may be. The types of contaminants that are found in the Canadian North include:

1. **Persistent Organic Pollutants (POPs)**, a group of mostly human-made chemicals which include **organochlorines (OCs)** and can stay in the

environment for many years without changing. POPs can be transported long distances in the atmosphere and ocean.
2. **Heavy metals** such as **mercury**, **cadmium**, and **lead**; and
3. **Radionuclides** such as cesium, **strontium**, and polonium.

COPPER
Copper is a reddish metal found naturally in some soils and rocks. It is a very good conductor of heat and electricity, and is often used to make electrical wires.

DDE
DDE is a **POP** found in the environment as a result of the breakdown of **DDT**, an insecticide.

DDT
DDT is a **POP** developed in the 1940s to kill lice and to kill biting insects that carry diseases such as malaria, yellow fever, and typhus. DDT was heavily used to kill insects feeding on crops in the 1950s and 1960s in the Great Lakes region until it was found to be harmful to other forms of life. DDT is banned in Canada.

DEOXYRIBONUCLEIC ACID (DNA)
DNA contains all the genetic information of a species. This information can be used to reproduce other organisms of the same species and is passed on fromgeneration to generation through the offspring.

DEMETHYLATION
Demethylation is the **enzymic** removal of a methyl group. Methyl groups are the most basic molecular structures in **organic** chemistry.

DIOXINS/FURANS
Dioxins and furans are highly **toxic** chemical substances. In small doses, these substances do not appear to be a threat. However, large doses of dioxins and furans are known to cause serious health problems, including **cancer**, in laboratory animals. The biggest source of dioxins and furans in Canada is the large-scale burning of municipal and medical waste.

DISEASE RESISTANCE
Disease resistance refers to the ability of animals and plants to withstand the attack from a disease.

ECOSYSTEM
An ecosystem is a system that is formed by the interactions of organisms with their non-living environment. The organisms and the environment work together as a unit, called an ecological unit.

ENDOCRINE-DISRUPTING EFFECTS
The endocrine system primarily controls metabolic activities through hormones. Endocrine glands secrete hormones into the blood, which carries these chemical messages to the target cells. Endocrine- disrupting chemicals interfere with this process by mimicking hormones and/or blocking the target sites.

ENDOSULFAN
Endosulfan is a **POP** generally used as an insecticide in the control of crop insects and mites.

ENZYME (ENZYMIC)

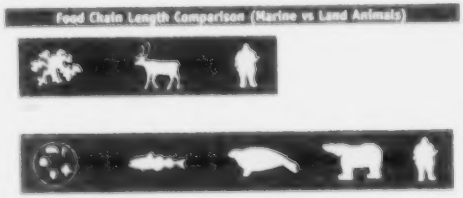
A biological compound that helps the body to process chemicals. Some enzymes are responsible for digesting protein in food. Other enzymes found in the liver are responsible for getting rid of **contaminants**.

FALLOUT

Fallout describes how particles that are held in the air descend to the ground and accumulate on surfaces. Fallout is generally associated with particles that have been sent into the atmosphere following a nuclear explosion or a volcanic eruption and slowly descend, falling onto ground or water surfaces.

FOOD CHAIN

Plants and animals can be linked together in feeding relationships called food chains. At the bottom of food chains are green plants that convert sunlight into food energy for the rest of the chain. Animals that eat the plants are then eaten by another animal, and so on up the chain. The number of animals involved can vary. For example, in the North, the lichen—> caribou—> human food chain has fewer feeding links, and is much shorter than the algae (a small plant that lives in water but needs sunlight)—>fish—>seal—>polar bear—>human food chain. In nature, food chains overlap to form **food webs**.



FOOD CONSUMPTION ADVISORIES

Food consumption advisories are sometimes issued by the Territorial health department in consultation with Health Canada when they determine that the levels of **contaminants** in traditional/country food may risk the health of those who eat this food. Such an advisory may recommend, for example, that people should only eat a certain number of livers from a particular fish species in a year.

FOOD WEB

A food web is the interaction of **food chains**. Food chains, which involve a direction from lower to higher ordered organisms, interact with one another in nature and form webs. These webs are more complex than chains as different organisms cross over into other chains and complicate the flow of energy from one species to another.

GENE EXPRESSION

Pertaining to a gene that is active in nature (not dormant). In order for a gene to become active it must undergo a conversion of the information encoded in a gene first into messenger RNA and then to a protein.

HEAVY METALS

Heavy metals are naturally-occurring metals found in rocks and soils. They are also released to the environment by human activities. They generally do not decay into other elements and therefore persist in the environment. Examples of heavy metals are **mercury** and **cadmium**.

HEXABROMOCYCLODODECANE (HBCD)
Hexabromocyclododecane is a **POP** used for thermal insulation foams, in building and construction in order to meet required high fire safety standards. HBCD is also applied in the backcoating of textiles, mainly for upholstery furniture. It is known to be **persistent**, **bioaccumulative**, **toxic**, and can be transported great distances.

HEXACHLOROCYCLOHEXANE (HCH)
Hexachlorochyclohexane (HCH) is a **POP** used to kill insects, an insecticide. It does not break down easily in the environment, and can be transported great distances in the atmosphere.

IMMUNE SYSTEM
The immune system is made up of cells and tissues responsible for recognizing and attacking foreign microbes and substances in the body.

IMMUNOLOGICAL
Related to the study of the **immune system**.

IMMUNOTOXIC
Something, e.g. bacteria or chemical, that causes damage to the **immune system** is immunotoxic.

INORGANIC
Inorganic material is inanimate (e.g. non-living) in nature and makes up the **abiotic** environment.

IN UTERO
In utero is a Latin-based term that means within the womb.

IN VIVO
In vivo is a Latin-based term that means in life. It is usually used to describe bodily functions or reactions within a living organism.

ISOTOPE
Isotopes are species of atoms of the same element with nearly identical chemical behaviour but with different mass and physical properties. For example, different isotopes of carbon and nitrogen can be found in nature.

ISOMER
Isomers are different forms of the same chemical compound, being made up of the same number and composition of atoms, but in different arrangements. Each isomer can have slightly different properties.

LEAD
Lead is a soft, blue-grey, easily-worked **heavy metal** that is naturally present in rocks and soils. It is used to make some kinds of glass, shot for shotguns, and combined with other metals for use in a variety of metallic items. Lead may be released to the environment by human activities, including the use of leaded-gasoline (in North America, lead was added to gasoline until the 1980s). Lead can be **toxic** to living things. In animals and people, lead accumulates in the brain and bones.

LIPOPHILIC
Attracted to fatty tissues.

LONG-RANGE TRANSPORT

Long-range transport refers to the movement of **contaminants** through the atmosphere or the ocean from distant sources. Many contaminants that are detected in the Arctic have been used in places rather far away but travel through the air and ocean currents contaminants that are detected in the Arctic have been used in places rather far away but travel through the air and ocean currents eventually reaching the Arctic where they are deposited.

MERCURY

HG Mercury is a **heavy metal** that is naturally found in rocks and soil in combination with other chemicals. It is the only metal that is liquid at room temperature. It is silvery in colour and flows easily so it is sometimes used in thermometers. There are many human-made sources of mercury that are released into the atmosphere. Also, mercury may be released when soils are flooded in the creation of reservoirs for making electricity (hydroelectric dams). Mercury is **toxic** to most living things. It accumulates in the liver, kidneys, hair, and skin of animals and people.

METHYLMERCURY

Mercury, like other metals, can be found in differentchemical forms in the environment. Methylmercury is a mainly **organic** form of mercury that is the most **toxic** and likely to cause effects. Methylmercury can also **bioaccumulate** and **biomagnify** in **food webs**.

METABOLISM

The sum of physical and chemical processes occurring within a living cell or organism that are necessary for the maintenance of life. Under these processes, substances are broken down to provide energy for certain vital processes while other substances, necessary for life, are created.

METABOLITE

A substance essential to the **metabolism** of a particular organism or to a particular metabolic process.

NEUROBEHAVIOURAL

Neurobehavioural effects are the way the brain affects emotion, behaviour, and learning via the nervous system.

NEURODEVELOPMENT

Neurodevelopment is the development of the nervous system.

NEUROMOTOR

Neuromotor is the nerve fibre or impulse going away from the central nervous system towards an effector (the ending of a nerve).

NEUROTOXIC

Neurotoxic effects are caused by substances that areconsidered to be **toxic** to living organisms. These substances can cause irreversible damage to the central nervous system.

NEUTRALS
A compound that is neither acidic nor basic and does not break into ions in solution.

NORTHERN CONTAMINANTS PROGRAM
The Northern Contaminants Program (NCP) has been developed through consultation with the scientific community, northern Aboriginal organizations, other governmental departments, and northern communities. Its goal is to reduce and wherever possible eliminate **contaminants** in traditional/country food. This goal is supported by involving northerners in the program, and by providing them with the tools and information for making their own informed decisions on food consumption.

NUNAVIMMIUT
Nunavimmiut are Inuit residents of Nunavik.

NUNAVUMMIUT
Nunavummiut are Inuit residents of Nunavut.

OOCYTES
A cell that gives rise to an ovum (female egg cell) by meiosis (cell division).

ORGANIC
Organic material is derived from living organisms and is made up of carbon-based compounds.

ORGANOBROMINE
Organobromines are bromine-containing chemicals made by humans. Several organobromines are used as flame retardants in plastics.

ORGANOCHLORINES (OC)
Organochlorines (OCs) are **chlorine**-containing chemicals made by humans. Organochlorines dissolve in fats and oils, and therefore are stored in the fat and blubber of animals (i.e. **bioaccumulate**) and are passed on through the **food chain** (i.e. **biomagnify**). Examples of OCs include: **toxaphene** and **chlordane**. Organochlorines can be **toxic** or poisonous to living things.

OXIDATIVE STRESS
Oxidative stress is a condition where increased oxidant production in organisms is characterized by the release of very unstable and highly reactive molecules resulting in cellular degeneration.

PBDEs/BDPEs
Polybrominated diphenyl ethers and brominated diphenyl ethers are a group of human-made **organobromine** chemicals that are used as flame retardants in various plastic materials, such as polystyrene. (See also **polybrominated biphenyls** (**PBBs**).

PCBs
Polychlorinated biphenyls (PCBs) are a group of human made, industrial **POP** chemicals. There are many different kinds of PCBs. Because they do not conduct electricity, PCBs were used in electrical transformers as insulators since the 1930s. PCBs do not break down easily in the environment and there is concern that they may be harmful to living things. Some kinds of PCBs are thought to cause **cancer** and may contribute to other subtle effects in unborn

children. The use of PCBs was banned in many countries, including Canada, in the 1970s.

PATHOLOGY
The study of the essential nature of diseases and especially of the structural and functional changes produced by them.

PERFLUORINATED ACIDS (PFAs)
Perfluorinated acids (PFAs) have no known route of degradation or metabolism under normal environmental conditions, meaning that they are extremely persistent in the environment. Examples of PFAs are **perfluorooctane sulfonate (PFOS)** and **perfluorooctanoic acid (PFOA)**.

PERFLUORINATED COMPOUNDS (PFCs)
PFCs are extensively manufactured compounds that can be found in surfactants, lubricants, refrigerants, fire retardants, drugs, cosmetics, and paints. Ongoing studies are demonstrating that some of the PFCs are **persistent**, **bioaccumulative** and subject to **long range transport**. One of the most common PFCs is **PFOS (perfluorooctane sulphonate)**, which has been found at increasing levels in Arctic wildlife.

PERFLUOROOCTANE SULFONATE (PFOS)
Perfluorooctane sulfonate is an example of a **perfluorinated acid (PFA)** that has recently been identified in liver and blood of polar bears and seals in the Arctic, including some samples from Nunavut. There is a lot of concern about the presence of this chemical in the environment as PFAs are highly **persistent** and not known to degrade. They can cause **cancer**, lead to enlarged livers as well as affect the fertility of wildlife.

PERFLUOROOCTANOIC ACID (PFOA)
Perfluorooctanoic acid (PFOA), similar to **perfluorooctane sulfonate (PFOS)**, is a **perfluorinated acid (PFA)** that has recently been identified in liver and blood of polar bears and seals in the Arctic, including some samples from Nunavut. There is a lot of concern about the presence of this chemical in the environment as PFAs are highly **persistent** and not known to degrade. They can cause **cancer**, lead to enlarged livers as well as affect the fertility of wildlife.

PERSISTENT
Persistent, when referring to chemicals, is the resistance of a chemical to break down. A persistent chemical, once introduced, stays in the environment for an indefinite length of time.

PERSISTENT ORGANIC POLLUTANTS (POPs)

Persistent organic pollutants (POPs) are a group of human-made chemicals used as **pesticides** and industrial chemicals, which include the substances called **organochlorines (OCs)**. POPs can be transported long distances in the atmosphere and can stay in the environment for many years without changing.

PESTICIDES
Pesticides are poisons used to kill pests (plants or

animals that are a nuisance or harmful). There are two main types: insecticides used to kill insects, and herbicides used to kill weeds, mold, and fungus. **Chlordane**, **toxaphene**, **HCH**, and **DDT** are examples of pesticides.

POLYBROMINATED BIPHENYLS (PBBs)

Polybrominated biphenyls are a group of human-made **organobromine** chemicals that are used as flame retardants in various plastic materials, such as polystyrene. (See also **PBDEs/BDPEs**.)

POLYCHLORINATED N-ALKANES (PCAs)

Polychlorinated n-alkanes are a group of **toxic** chemicals belonging to the polychlorinated aromatic compounds **(PCAs)**. Their most common applications include use as high temperature lubricants in metal-working machinery.

POLYCHLORINATED NAPTHALENES (PCNs)

These chemicals are a group of 75 compounds which have been used as lubricants, fungicides, insecticides, and as insulators which pre-date **PCBs**. They are similar in structure to PCBs, and are **toxic**.

POLYPEPTIDE

A chain of amino acids linked by a chemical bond formed between neighbouring amino acids. Many polypeptide chains combined to form a protein.

POWER ANALYSES

A statistical tool used to estimate the probability that an experiment will be able to reject a false null hypothesis.

QUALITY ASSURANCE/QUALITY CONTROL

QA/QC

Because research is conducted by many different people in many regions across the country, it is often difficult to ensure that the same standards in producing data are in use. Quality assurance/quality control is a system of procedures and corrective actions that attempt to ensure that the different research studies, environmental monitoring and sampling, and other technical and laboratory activities are comparable with one another and the data reported are of the highest quality possible.

RADIONUCLIDES

Radionuclides are atoms that emit radiation and, like **heavy metals**, are naturally present in rocks and soils. They may also be human-made. Certain kinds of radionuclides have been released into the environment through atmospheric testing of nuclear weapons, nuclear waste dumping and uranium mining. Radionuclides tend to accumulate in the bones and muscles of animals and people. Natural radionuclides in the Canadian North include polonium and **lead**.

RISK ASSESSMENT

The qualitative and quantitative study of the risk posed to human health and the environment by the presence and/or use of specific pollutants.

SELENIUM

Selenium is a nonmetallic element that resembles sulfur. It can be naturally found in rock and soils from

some areas and it has been suggested that at the right concentration, it can counteract the effects of **mercury**, but this is unproven as of yet.

SERUM
The fluid part of blood is called plasma. Serum is this fluid minus the fibrogen (blood clotting property).

SPATIAL PATTERNS
Variations over a given geographic area.

STATISTICAL POWER
The probability that an effect (change) can detect if an effect really occurs. When a particular test is not statistically significant it because there is no effect, or because the study design makes it unlikely that a real effect could be detected. **Power analyses** can distinguish between these alternatives, and is therefore a critical component of designing experiments and testing results.

STOCKHOLM CONVENTION
The Stockholm Convention is a global treaty to protect human health and the environment from **persistent organic pollutants (POPs)**.

STRONTIUM
A naturally occurring radioactive element which is used to date rock and sediments.

TEMPORAL TRENDS
Changes over time.

TOXAPHENE
Toxaphene is a **POP** chemical that was used as a **pesticide** from the 1950s to 1970s. It is very poisonous to living things, especially fish. Toxaphene has never been licensed for use in Canada, and it was banned in the United States in 1982.

TOXIC (TOXICITY)
Toxic (toxicity) refers to the capability of a substance to cause harm or be poisonous to humans, animals, or other living things. In common usage, the term toxic substances refers to chemical substances that are capable of causing harm at very low levels of exposure.

TOXICOLOGY
Toxicology refers to the scientific study of the effects, chemistry, and treatment of poisonous (toxic) substances.

TROPHIC LEVELS
Levels in a **food web** characterized by organisms which are the same number of steps removed from the primary producers of **ecosystems** (e.g. generally aquatic and terrestrial green plants comprise the first trophic level, and plant-eating organisms comprise the second.)

VAPOUR
A substance in the gaseous state, as distinguished from a liquid or solid state.

ZINC
Zinc is a brittle metal at ordinary temperatures, and is not found abundantly in nature. It is used in the preparation of certain metal alloys, like bronze and brass. An excess of zinc can be **toxic**.

ZOOPLANKTON
The passively floating or weakly swimming usually microscopic animal life in a body of water.

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The following list can be used to search for a project by affiliation or project leader.

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For More Information

If you wish to obtain more information on any of the projects within this booklet or have any questions regarding contaminants in general, please feel free to contact any of the persons listed below; they will be glad to assist you.

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